THE HEATING AND VENTILATING MAGAZINE

1123 BROADWAY NEW YORK JUNE, 1907

NATIONAL ASSOCIATION OF MASTER STEAM AND HOT WATER FITTERS

WHO HELPS ME I HELP

Nineteenth Annual Convention, Washington, D. C., May 20-23, 1907

Although favored by an attendance smaller than that of previous years, the importance of the matters down for discussion made the nineteenth annual convention of the National Association of Master Steam and Hot Water Fitters at Washington, May 20-23 last, one of the most notable meetings in its history.

Some of these matters, such as the agitation regarding the replacement of defective parts and sub-contracting with general contractors, are referred to in detail in President Gormly's address. During the course of the convention a further effort was made, but without avail, to formulate a working agreement regarding defective parts between representatives of the Manufacturers' Association and the National Association of Master Steam and Hot Water Fitters.

The convention, however, went on record in a number of important resolutions, among which was one recommending the members to use the rubber stamp (providing for the replacement of defective parts) in placing their orders for steam-fitting materials.

OPENING SESSION

The convention was called to order for its first regular session Tuesday morning, May 21, at 10:30 A. M., by President Gormly, in the meeting hall of The Arlington, which was admirably suited for the purpose. Those present at this or subsequent sessions included the following:

P. Gormly, Philadelphia, Pa.
William J. Baldwin, Jr., New York.
J. A. Almirall, New York.
A. E. Kenrick, Brookline, Mass.
John C. F. Trachsel, Philadelphia, Pa.
James M. Healy, Indianapolis, Ind.
John T. Sadler, Elmira, N. Y.
George H. Zellers, Washington, D. C.
Edward B. Denny, Newark, N. J.
John F. Buerkel, Boston, Mass.
Henry B. Gombers, New York.
Stewart A. Jellett, Philadelphia, Pa.
J. T. Bradley, St. Louis, Mo.
M. G. Sellers, Philadelphia, Pa.
F. M. Boykin, Jr., Boston, Mass.
E. D. Smith, New York.
Enoch Rutzler, New York.
William M. Mackay, New York.
E. J. Febrey, Washington, D. C.
Samuel H. Billson, Washington, D. C.
John P. Gallivan, Boston, Mass.
Angus B. Weaver, Buffalo, N. Y.
T. B. Cryer, Newark, N. J.
A. S. Armagnac, New York.
W. W. Biggs, Washington, D. C.
H. L. Anness, New York.
R. W. Hillman, New York.
W. E. Jacobus, Philadelphia, Pa.
W. H. McCuen, Washington, D. C.
R. E. Kriebel, Philadelphia, Pa.
H. H. Hess, New York.
W. P. Thompson, Philadelphia, Pa.
James J. Lawler, New York.
Harry S. Martin, Dunkirk, N. Y.
W. S. Appleton, New York.
M. E. Danforth, Washington, D. C.

MEMBERS AND GUESTS OF NATIONAL ASSOCIATION OF MASTER STEAM AND HOT WATER FITTERS, IN ATTENDANCE AT THE RECENT WASHINGTON CONVENTION

Those seated in the front row, reading from left to right are: U. G. Scollay; J. A. Almirall; Chairman S. A. Jellett, of the Trade Relations Committee; Sergeant-At-Arms J. C. F. Trachsel; Vice-President James M. Healy; Director John F. Buerkel; President John T. Sadler; Ex-President P. Gormly; Treasurer William J. Baldwin, Jr.; Secretary Gombers; Director George H. Zellers and Director Edward B. Denny.

George W. Barr, Philadelphia, Pa.
Joseph A. Graham, New York.
E. R. Soleau, Newark, N. J.
Harry Geiser, Newark, N. J.
M. C. Honeywell, Wabash, Ind.
W. L. Herendeen, Geneva, N. Y.
Joshua A. Naylor, Baltimore, Md.
Homer Addams, Allentown, Pa.
P. H. Seward, New York.
Frank Dobson, New York.
L. Moore, Portchester, N. Y.
U. G. Scollay, Brooklyn, N. Y.
George D. Hoffman, Chicago, Ill.
John W. Rowe, New York.
J. D. Stiles, Boston, Mass.
J. C. Faulkner, New York.
C. A. Miller, New York.
W. H. Bateman.
James A. Donnelly, New York.
E. DeForest Winslow, Chicago, Ill.
F. R. Austin, New York.
C. H. Tower, New York.
George H. Morris, New York.
W. G. LeCompte, New York.
William R. Watters, New York.
J. J. Blackmore, New York.
J. Lucas, Philadelphia, Pa.
P. M. Beecher, Syracuse, N. Y.
G. H. Giles, Philadelphia, Pa.
Frank J. Corbett, New York.
E. H. Roberts, New York.
C. N. Brizse, New York.
G. M. Bridgman, Philadelphia, Pa.
E. P. Allen, Chicago, Ill.
Frank K. Chew, New York.
Wallace S. Cosgrove, Jersey City, N. J.
A. S. Mappett, Philadelphia, Pa.
C. K. Foster, Chicago, Ill.
George E. Downe, Chicago, Ill.
C. A. Gott, New York.
Frank C. Howell, New York.
E. S. Stoughton, New York.
A. J. Kengla, New York.
F. L. Huddleston, Philadelphia, Pa.
Maxwell Gilbert, Philadelphia, Pa.
Howard T. Gates, New York.
B. N. Hurd, New York.
William Grier, Baltimore, Md.
F. D. Miller, Washington, D. C.
Wiltsie F. Wolfe, Philadelphia, Pa.
Albert B. Jenkins, New York.
W. S. Newkirk, New York.
T. M. Ward, New York.
Charles S. Wood, New York.
Harding Benedict, New York.
Arthur F. Sawyer, Philadelphia, Pa.
Thomas C. Taylor, Philadelphia, Pa.
A. F. Howe, Warren, Ohio.
C. V. Haynes, Philadelphia, Pa.
E. O'Brien, Indianapolis, Ind.
E. L. Stock, Washington, D. C.
Thomas E. Crane, Utica, N. Y.
E. R. Euston, Myerstown, Pa.
C. S. Zimmerman, Newark, N. J.
O. P. Simler, Johnstown, Pa.
W. Speakman, Pittsburg, Pa.
T. V. Foster, New York.
George Kirkhoff, Indianapolis, Ind.
S. P. McMullin, Williamsport, Pa.
D. W. Lyle, Williamsport, Pa.
Frank Sprague, Oswego, N. Y.
Walter W. Talcott, No. Tonawanda, N. Y.
Gilbert G. McDuff, New York.
H. S. Hadden, New York.
Henry L. Hall, New York.
E. Monroe.
W. C. McCormick, New York.
Joseph Geoghegan, New York.
J. T. McDavit, Philadelphia, Pa.
F. A. Clegg, Louisville, Ky.
Robert Purse, Johnstown, Pa.
Earle Sloan.
F. Eitapene, Binghamton, N. Y.
W. H. Gaylord, Binghamton, N. Y.
W. H. Gottlieb, Washington, D. C.
T. J. Zimmerman, Newark, N. J.
J. G. Goris, Lafayette, Ind.
H. H. Highlands, Muncie, Ind.
William A. Russell, New York.
John H. Waters, Johnstown, Pa.
T. J. Hayes, Indianapolis, Ind.

Before beginning the regular order of business the president summoned Sergeant-At-Arms Trachsel to the Chair and formally presented him with a handsome badge of his authority bearing the words "Sergeant-At-Arms, N. A. M. S. & H. W. F.," and also the motto of the association. After expressing his appreciation of the gift, which Mr. Trachsel said would be worn over his heart, President Gormly produced another much larger badge, the size of which startled even the staid sergeant-at-arms. This, said the president, was designed for convention use and was intended to leave no doubt in the minds of those in attendance as to the identity of the sergeant-at-arms. Mr. Trachsel, in acknowledging the insignia, said that he felt like the small boy who had hard work to keeping pace with his father and exclaimed, "Father, I'm winded."

President Gormly then delivered his address, which was as follows:

President's Address

It is a pleasure again to greet you on this occasion of our nineteenth annual convention. You are assembled to receive, among other things, an accounting from those you intrusted during the year with the active management of your affairs and who were charged with the important duty of maintaining and upholding the constitution and laws of the association and enforcing the principles which have guided us from

the beginning of our corporate existence. The reports of your officers and standing committees will be heard during the proceedings. You will decide whether they have performed their duties faithfully and acceptably.

THE DEFECTIVE MATERIAL QUESTION

Much time has been devoted during the past year to conference and correspondence with the Manufacturers' Association in an effort to formulate an equitable plan or agreement through which the measure of responsibility could be fixed for loss caused us by the purchase and installation of defective material, provided such were sold to us as perfect goods. We do not assert that any reputable manufacturer or jobber will deliberately misrepresent the character of the goods we purchase, but it is not denied by them that serious errors entailing loss to us are sometimes made by their workmen, or salesmen, in the manufacture and distribution of these goods, and we deny the justice of the rule they would enforce, which is in effect that partial restitution shall be made for a wrong that is wholly their own.

A MIXED TRIBUNAL PROPOSED

It is high time that some method or agreement be adopted by which equitable and prompt settlement may be made of all such disputes, and I believe the appointment of a mixed tribunal, such as we propose, for the adjustment of disputed claims of this kind would result in as great a benefit to the manufacturer as to ourselves. The very existence of a body governed by definite rules of procedure and representing the National Association of Manufacturers and of Master Steam and Hot Water Fitters would have a deterrent effect on the master fitter, who otherwise might be tempted to take an unfair advantage, as well as on the salesman or workman of the manufacturer, who may be called to account for his derelictions.

Our views on this matter are concurred in by a large number of manufacturers and jobbers, who admit the justice of our contentions. Still, we have some sincere and valued friends who are slow to adopt our suggestions. I may say, however, it is intended to have during this convention another conference, when it is hoped our different opinions may be reconciled, and a platform having mutual advantages will be considered and adopted.

THE USE OF THE STAMPED ORDER

Pending this, and forestalling action by the National Association, many of our state and local associations for their own business protection have adopted and put in operation for their members what is known to the trade as the stamped order, the conditions of which place responsibility for loss on account of defective goods on those who sell under its conditions. It has been found where the stamp is in general use on orders that much greater care is exercised in filling them, and cause for complaint has been reduced to the minimum.

While some manufacturers and jobbers in these localities still refuse the stamped order, they are few compared to those who willingly accept it. In some cases a slight premium or advance is charged because of the conditions, this being set aside by the jobber or manufacturer as an insurance fund from which all losses resulting from its acceptance are paid. This, I believe, to be the sensible and businesslike treatment of the subject, and during more than a year in which it has been in operation it has proved satisfactory to all concerned.

SUB-CONTRACTS WITH GENERAL CONTRACTORS

There is another important matter which should be considered during this convention: It is that of subcontracting or the acceptance of any considerable share of your business through irresponsible builders or general contractors. This practice has grown in some parts of the country until it has become an abuse. It is not claimed that all such business is necessarily worthless and undesirable; there are no doubt some excep-

tions, which may serve to prove the rule. Those who follow the practice and depend upon that source for a large percentage of the business they do are treading on dangerous ground, not because the general contractor is dishonest or dishonorable, not because he is always financially irresponsible, but because you cannot afford to divide your profits with anyone and still do justice to those who depend upon your business judgment and ability.

You necessarily assume with him without remuneration of any kind for it an unfair proportion of the risk which attends any business, but particularly that of general building construction. You exonerate the responsible owner of the property from all responsibility; you take less than the best security for your values; can you logically hope for any but the usual result of such procedure? The business history of our craft is filled with stories of disaster arising from this cause; they vary in detail, but the result is always about the same. The case is rare in which there is real necessity for the sacrifice you make. The general contractor seldom furnishes or equips the building he has erected. He rarely provides the piano, the china, or silverware, the furniture, carpets, electric or gas fixtures. It is customary for the owner to purchase these things directly. This custom has grown from the wise practice of the men who make, sell or install such material. They minimize their business risk by avoiding the broker, or builder, who knows little about the merits or details of their business, except for the profit that may be made through the mere act of assembling and directing those who are willing to furnish the capital, the skill and the labor and then divide the profits with him.

In some localities this abuse has been recognized and discussed, and efforts have been made to correct it. Your national office has not been idle in this matter. The incoming administration will have ample opportunity to discuss the subject with those who not only are alive to the danger of it, but have in great measure the power in their hands to minimize or destroy the practice. I refer to the American Institute of Architects. There may come a test of your loyalty in this matter and on it will depend the success or failure of the movement.

WORK OF ORGANIZATION SUSPENDED

During the past year it was found that the field of organization was well covered by the national organizer, supplemented by the work of the several local associations, and that a majority of the desirable firms in the business had joined our association through their local organizations. Therefore, it was thought wise by your board of directors to suspend for a time the work of the national organizer. This was done last October. It is true there are a few desirable firms in the business whom we would be glad to welcome to membership, but for reasons of their own they prefer at present not to join with and aid us in the work in which we are engaged. This is their right and privilege, and it is not the province nor practice of this association to question or try to abridge the rights of anyone while asserting and maintaining not only the rights of its members, but those of the entire trade.

STATE ORGANIZATION SHOULD BE STRENGTHENED

I believe our next step in the direction of organization should be made to strengthen state, rather than local, associations. We have now some well-organized state associations and the work is progressing favorably. It needs but the firm guidance of the national administration in order to have alert and active forces everywhere, who are constituted to act promptly and effectively in all matters, but chiefly in protecting our isolated members or those who cannot have the benefits of a local association. This is a necessary work, and one that must strengthen the usefulness and efficiency of the local and national associations.

DOING BUSINESS WITH THOSE ON LIST IN ACCORD

I would call your attention briefly to your duty in confining your purchases when possible to those whose names appear in the *Official Bulletin* on the List in Accord. If you will realize fully this duty and the power derived from the faithful performance of it, you will hesitate when tempted to ignore it. It is, as a rule, well observed by our members, but for those who are sometimes careless or indifferent about it, I would say that every time you unnecessarily violate it, you violate the well-known motto of your associations and strike an undeserved and needless blow at your national officers.

In this list of merchants and manufacturers, as maintained for you by the national office, and by it issued every month through your official magazine, you have one of the most powerful instruments for your protection and welfare that is possessed by any business organization. I would ask that you scan the pages of your "Bulletin" immediately on receiving it, and when you have carefully noted its contents, hang it conspicuously in your office, that all who observe it may learn its import and profit by the knowledge gained.

WORDS OF APPRECIATION

At this time I wish to express my appreciation of the honor you have twice conferred on me. I have endeavored to justify your confidence by attending to the duties of this high office to the best of my ability. I have not achieved all that I aimed to accomplish; doubtless I have made mistakes, but these are human, and no one who is active is exempt from them. Therefore, I have a claim on your leniency. I wish to thank publicly the officers and committees associated with me, and through whose efforts, more than through any act of mine, success and harmony have prevailed throughout my incumbency, and last, but not least, I wish to thank the members everywhere, not only for the many courtesies extended because of the office I hold, but rather because of the spirit of fraternity they exemplified and their recognition of me as a co-laborer with them, the prompt and hearty support and assistance they accorded me and all who were associated with me in the administration of the office.

After announcing the entertainment plans, President Gormly named the following as a Committee on Credentials: A. E. Kenrick, Brookline, Mass.; J. T. McDavit, Philadelphia, Pa.; E. R. Soleau, Newark, N. J.; T. J. Hayes, Indianapolis, Ind.; and Samuel Billson, Washington, D. C. The convention then adjourned until 2 o'clock.

In the afternoon Chairman Kenrick presented the report of the Credential Committee, showing that 344 members were entitled to sit in the convention.

The appointment of the following committees was then announced:

NOMINATING COMMITTEE

George H. Morris, New York; S. A. Jellett, Philadelphia; J. T. Bradley, St. Louis, Mo.; George Kirkhoff, Indianapolis, Ind.; A. E. Kenrick, Brookline, Mass.

AUDITING COMMITTEE

J. A. Almirall, New York; Harry Geiser, Newark; Frank Dobson, New York.

WAYS AND MEANS COMMITTEE

Enoch Rutzler, New York; W. H. Gottlieb, Washington; C. P. Zimmerman, Newark.

APPEALS AND GRIEVANCES COMMITTEE

U. G. Scollay, Brooklyn; William P. Thompson, Philadelphia; J. G. Goris, Lafayette, Ind.

CONSTITUTION AND BY-LAWS COMMITTEE

E. B. Denny, Newark; H. H. Highlands, Muncie, Ind.; Robert Purse, Johnstown, Pa.

The convention thereupon went into executive session, adjourning late in the afternoon until the following morning.

During the Wednesday morning

session, which was an executive meeting, the reports of the treasurer and board of directors were presented. Following is the treasurer's report:

Report of Treasurer

Cash on hand May 1, 1906....	$3,443.11
Receipts, May 1, 1906, to May 1, 1907	15,020.68
Total.....	$18,463.79
Expended, May 1, 1906, to May 1, 1907	13,035.09
Cash balance May 1, 1907.....	$5,428.70

Respectfully submitted,
(Signed) WILLIAM J. BALDWIN, JR., Treasurer.

The report of the board of directors is, in part, as follows:

REPORT OF BOARD OF DIRECTORS

The first meeting of this board was held at the St. Charles Hotel, Atlantic City, N. J., on June 22, 1906, and organized by electing Charles A. Geoghegan chairman and re-electing Henry B. Gombers secretary, he having served in that capacity since April, 1897.

From May 1, 1906, to May 1, 1907, we added to our membership roll 146 members. The new membership is distributed as follows: Illinois, 31; Indiana, 19; Maine, 7; Massachusetts, 20; Minnesota, 22; Missouri, 8; Montana, 1; New Jersey, 8; New York, 5; North Dakota, 1; Pennsylvania, 6; Tennessee, 1; Texas, 4, and Wisconsin, 13.

P. Gormly and John T. Sadler have acted as a sub-committee of the Board of Directors on *Official Bulletin* matters. The editorial work and details in connection with the publication of the *Bulletin*, including the advertising department, have been in charge of Secretary Gombers. Taking the calendar year, instead of the fiscal year, for purposes of making comparison, we can report that volume No. 13, for the year 1906, is the largest ever published, being 20 per cent. larger than volume No. 12, for 1905, which in turn was larger than volume No. 11, published during 1904. If volume No. 14, for the current year, 1907, maintains the present rate of progress, it will show an increase in size over that of 1906, which, as heretofore stated, was the largest volume ever published by the association.

The Committee on Standardization, which was originally composed of A. C. Walworth, E. M. Nichols and B. P. Hall, has been changed, owing to the resignation therefrom of A. C. Walworth, who found it impossible to remain an active member by reason of duties and pressing engagements in other directions. Thomas B. Cryer, of Newark, N. J., was appointed a member of the committee with B. P. Hall, of New York, and E. M. Nichols, of Philadelphia.

Following the report of the Trade Relations Committee, the following recommendations of the committee were adopted by the convention:

The Trade Relations Committee's Resolutions

That this association recommends to the members that they use the rubber stamp in placing their orders for steam-fitting materials.

That if they find any difficulty in getting settlements of just claims, they send their claims, together with the facts bearing on the case, to national headquarters.

That at certain stated periods the Board of Directors of this association will, through conference with the manufacturers, adjust disputed claims of members.

During the afternoon session on Wednesday announcement was made of the new officers elected and they were then installed in the presence of the members and guests, including the ladies. The new officers are as follows:

Officers for 1907-1908

President, John T. Sadler, Elmira, N. Y.

Vice-President, James M. Healy, Indianapolis, Ind.

Treasurer, William J. Baldwin, Jr., New York.

Sergeant-at-Arms, John C. F. Trachsel, Philadelphia, Pa.

Directors: P. Gormly, Philadelphia; Charles A. Geoghegan, New York; John F. Buerkel, Boston, Mass.; Edward B. Denny, Newark, N. J.; G. H. Zellers, Washington, D. C.

In assuming the chair, President Sadler said he considered the present a critical time in the trade and urged the members to support the objects of the association even if at times it required a sacrifice. Mr. Stewart A. Jellett, chairman of the Committee on Trade Relations, also spoke along the same lines.

On motion of E. Rutzler, the usual votes of thanks were given the officers, the ladies, the manufacturers, the Arlington Hotel, the trade press and to Mr. Walter Higgins and the other Washington members for their part in providing the enjoyable entertainments for those present. A. E. Kenrick then moved that the convention adjourn sine die and this brought the meeting to a close.

Following the adjournment, the board of directors organized by electing the retiring president, P. Gormly, as chairman of the board. The board also re-elected Henry B. Gombers secretary.

Back Pressure in Exhaust Steam Heating

By Charles L. Hubbard

[Editor's Note.—In a previous article on the subject of exhaust steam heating it was noted that exhaust steam can be used for heating feed water without materially increasing the back pressure on the engine. When it is used for warming buildings, however, the back pressure is always an important factor and this loss is offset either by raising the initial or boiler pressure or by increasing the cut-off of the engine. In the following article, Mr. Hubbard shows graphically the important features connected with these two operations.]

The loss in power of an engine from back pressure is nearly proportional to the ratio of the back pressure to the mean effective pressure. This is shown graphically in Fig. 1.

Let the work done by one stroke of the engine be represented by the area A B C D E. If the rectangle F G D E be drawn, having an equal length and the same area, then the mean effective pressure will be represented by the height E F. Let E D be the normal back pressure line; then if it be raised to the position I J, the resulting lost work will be given by the area I J D E. As the rectangles F G D E and I J D E have the same length, their areas are as their heights, which represent the mean effective and back pressures respectively. From this it is evident that any increase in the back pressure cuts down the power in proportion to the ratio of the increase in back pressure to the mean effective pressure.

Example: The M. E. P. of an engine is 40 pounds and the back pressure is raised 5 pounds: what will be the loss in power? Five-fortieths = 1/8, or 12.5 per cent. loss in power.

Raising the Initial or Boiler Pressure

There are two ways of offsetting this loss. One is by raising the initial or boiler pressure, and the other is by increasing the cut-off of the engine. The first method is illustrated graphically in Fig. 2.

Let A B C D E be the indicator diagram of an engine exhausting against atmospheric pressure. If the back pressure line is raisd to the position I J, the lost work per stroke will be represented by the area I J D E; and, to offset this, the line of initial pressure must be raised to such a height

that the area A K L M C B will equal the area I J D E. The required increase in boiler pressure for offsetting the effect of a higher back pressure may be found, approximately, by the use of the following table:

Cut-off.	MEAN PRESSURE RATIOS Per Cent. Clearance.					
	0	1.75	3	5	7	9
1/16	.33	.35	.36	.39	.41	.43
1/8	.38	.40	.41	.43	.45	.47
1/6	.46	.48	.49	.50	.52	.53
1/5	.52	.53	.54	.55	.57	.58
1/4	.59	.60	.61	.62	.63	.64
3/16	.67	.68	.68	.69	.70	.71
1/3	.69	.70	.71	.71	.72	.73
3/8	.74	.74	.75	.75	.76	.77
2/5	.76	.77	.77	.78	.78	.79
7/16	.79	.80	.80	.81	.81	.82

To find the mean effective pressure exerted throughout the stroke, multiply the absolute initial pressure (above a vacuum) by the number opposite the given cut-off and in the column corresponding to the percentage of clearance, and deduct the absolute back pressure.

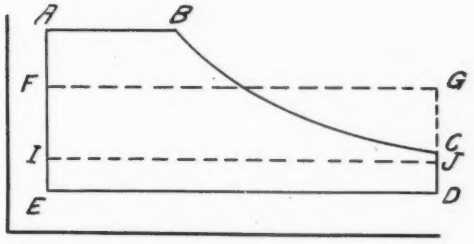


FIG. 1—SHOWING EFFECT OF BACK PRESSURE ON AN ENGINE

Example: An engine cutting off at 1/4 stroke is supplied with steam at 80 pounds gauge pressure, and exhausts into the atmosphere. The clearance is 5 per cent. It is desired to use the exhaust steam for heating, at a pressure of 5 pounds per square inch. How much must the boiler pressure be raised in order that the engine may have the same power at the same cut-off?

It is evident that if the power of the engine is to be kept the same, the mean effective pressure must remain constant. The normal back pressure on an engine exhausting into the atmosphere is about 2 pounds gauge. Referring to the above table, we find the ratio for 1/4 cut-off and 5 per cent. clearance to be .62, from which the mean pressure in the above case is $(80 + 15) \times .62 = 50$ pounds, and the mean effective pressure is 59—17 = 42 pounds.

If the back pressure is to be raised to 5 pounds gauge (an increase of 3 pounds), or 20 pounds absolute, the mean pressure must also be increased 3 pounds in order to keep the mean effective pressure the same. This calls for a mean pressure of 62 pounds absolute; and, dividing this by .62 (the ratio for 1/4 cut-off and 5 per cent. clearance), we have an initial pressure of $\frac{62}{.62} = 100$ pounds called for, instead of 95 as in the first case. This shows that under the conditions of the problem an increase of 3 pounds in back pressure requires a corresponding rise of 5 pounds in the boiler pressure to keep the power of the engine the same with a constant cut-off.

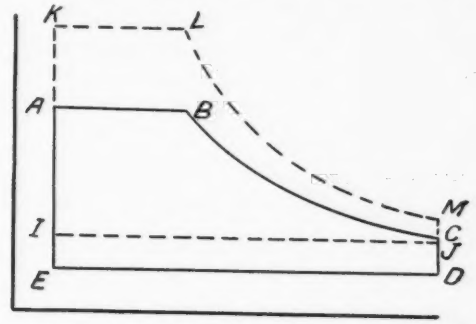


FIG. 2—SHOWING EFFECT OF RAISING INITIAL OR BOILER PRESSURE

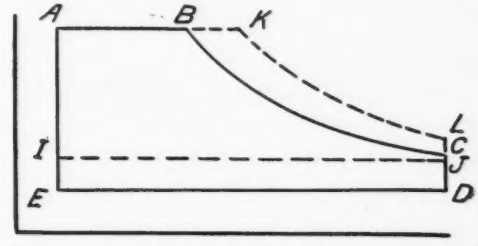


FIG. 3—SHOWING EFFECT OF INCREASING CUT-OFF OF ENGINE

INCREASING THE CUT-OFF OF THE ENGINE

The effect of the second method (this is, increasing the cut-off) is shown in Fig. 3, in which the added

area B K L C must equal I J D E. The necessary increase in the cut-off for any given case can also be found by the use of the table already given.

Example: An engine cutting off at $\frac{1}{5}$ stroke is supplied with steam at 100 pounds gauge pressure. Clearance of the engine, 3 per cent. It is desired to raise the back pressure 6 pounds above its present point. What must be the cut-off to maintain the same power of the engine without raising the boiler pressure?

The ratio for $\frac{1}{5}$ cut-off and 3 per cent. clearance, according to the table, is .54; and the mean pressure is $(100 + 15) \times .54 = 62$ pounds. If the back pressure is raised 6 pounds, the mean pressure must be increased the same amount in order to maintain the same power of the engine. This gives $62 + 6 = 68$ pounds as the required mean pressure under the new conditions. As the boiler pressure is to remain the same, the ratio between the mean pressure and initial pressure will become $68 \div 115 = .59$. Looking at the table, under 3 per cent. clearance, we find that the nearest ratio (which is .60) corresponds to a cut-off of $\frac{1}{4}$.

Engines are usually designed to work most economically at a given cut-off, so that in most cases it is undesirable to change the cut-off to any extent. Raising the boiler pressure, on the other hand, is not so objectionable if the increase amounts to only a few pounds.

---

*Cost of Heating Store Houses**

By H. O. Lacount

In the work of the Associated Factory Mutual Fire Insurance Companies the problem of protecting store houses and their valuable contents against fire has required careful study. In nearly all classes of manufacturing properties experience has conclusively demonstrated that the automatic sprinkler, supplied with ample water, is the best means of protection. As is generally known, the automatic sprinkler has an orifice about ½ inch in diameter which under normal conditions is closed by a valve held in place by links or struts, so arranged that on the melting of some fusible solder the valve is liberated and water immediately discharged. For the average case, a temperature of 160° F. is sufficient to open a sprinkler and the great work which the automatic sprinkler has done in reducing fire losses comes from the fact that it stands ready night and day instantly to deluge a fire with water at its start. The records show that the majority of fires are held in check, or even extinguished, by the opening of less than a half dozen sprinklers.

Long experience showed that store houses used for holding large amounts of cotton, wool, hemp, jute, together with the manufactured articles made from these stocks, and many other miscellaneous products, needed protection to prevent bad losses in much the same way that manufacturing buildings needed it. And again the automatic sprinkler was found the best device.

The larger part of the store houses, however, are not heated, so that in winter water in the sprinkler pipes would freeze. This led to the development of several types of automatic valves which would permit draining water from the sprinkler system during cold weather and filling the pipes with air under pressure. The valve, ordinarily known as a "dry-pipe valve," was so designed that on the opening of a sprinkler and the escape of the air the valve would let in the water. Experience again has shown that with valves of certain types, properly cared for, reliable sprinkler protection can be obtained in this way, and a large number of such equipments have been put in.

Dry-pipe valves add appreciably to the first cost of the equipment. They require frequent attention while in service, and there is necessarily a delay, averaging perhaps a minute, between the opening of a sprinkler and the discharge of water, which means where there are inflammable contents that the fire may spread, opening more sprinklers than would have been necessary had the first one instantly deluged the small blaze with water, the result being excessive water damage. Again, there is always the chance of a system being put out of commission for some time due to water freezing in the pipes in case they were filled and could not be promptly drained. For these reasons, it has always been considered preferable to have the full water pressure constantly on the heads,

*Presented at the Indianapolis, Ind., Meeting (May, 1907) of The American Society of Mechanical Engineers and to form part of Volume 28 of the Transactions.

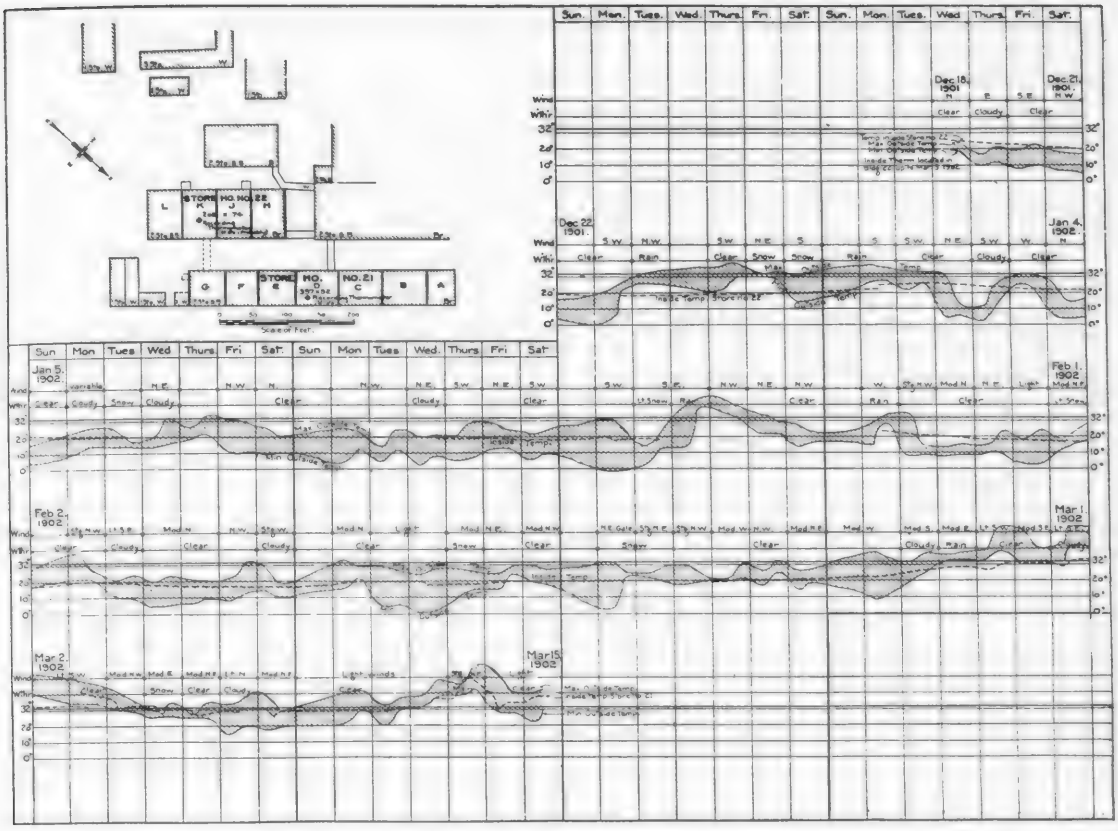


FIG. 1.—RECORD OF TEMPERATURES AT UNHEATED STORE HOUSE OF LEWISTON BLEACHERY AND DYE WORKS

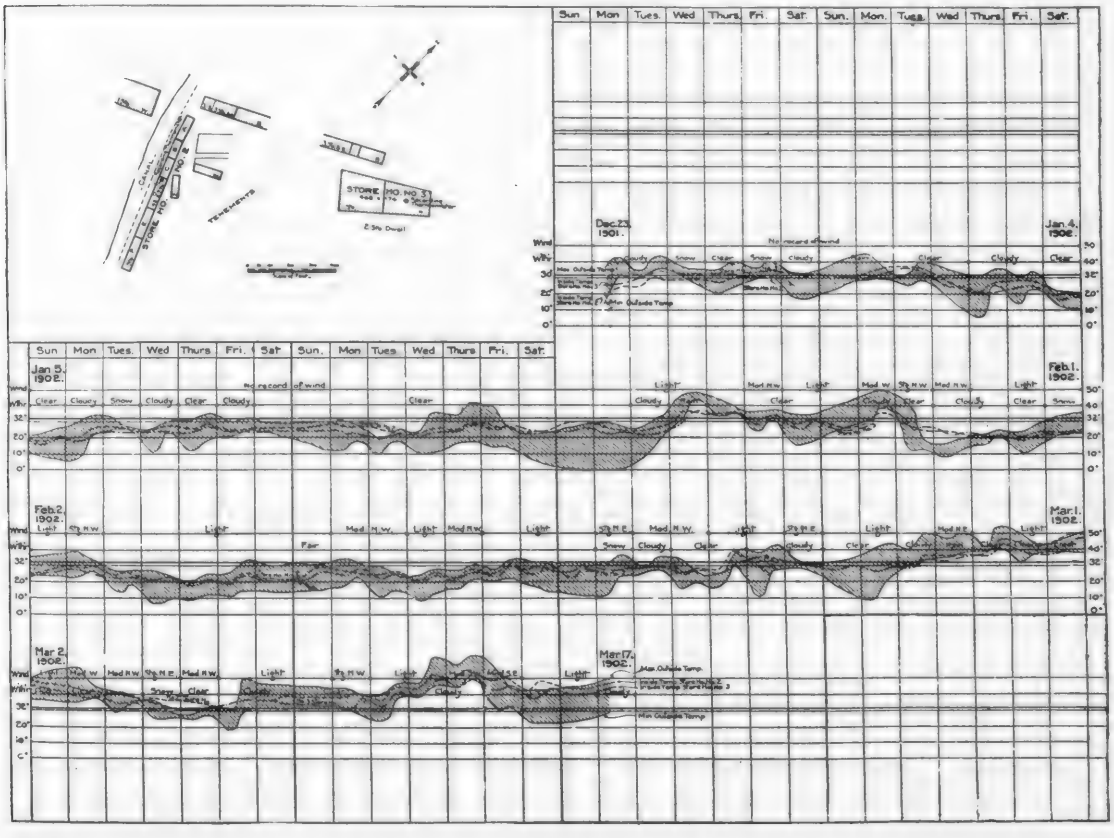


FIG. 2—RECORD OF TEMPERATURES AT UNHEATED STORE HOUSES OF NASHUA MANUFACTURING COMPANY

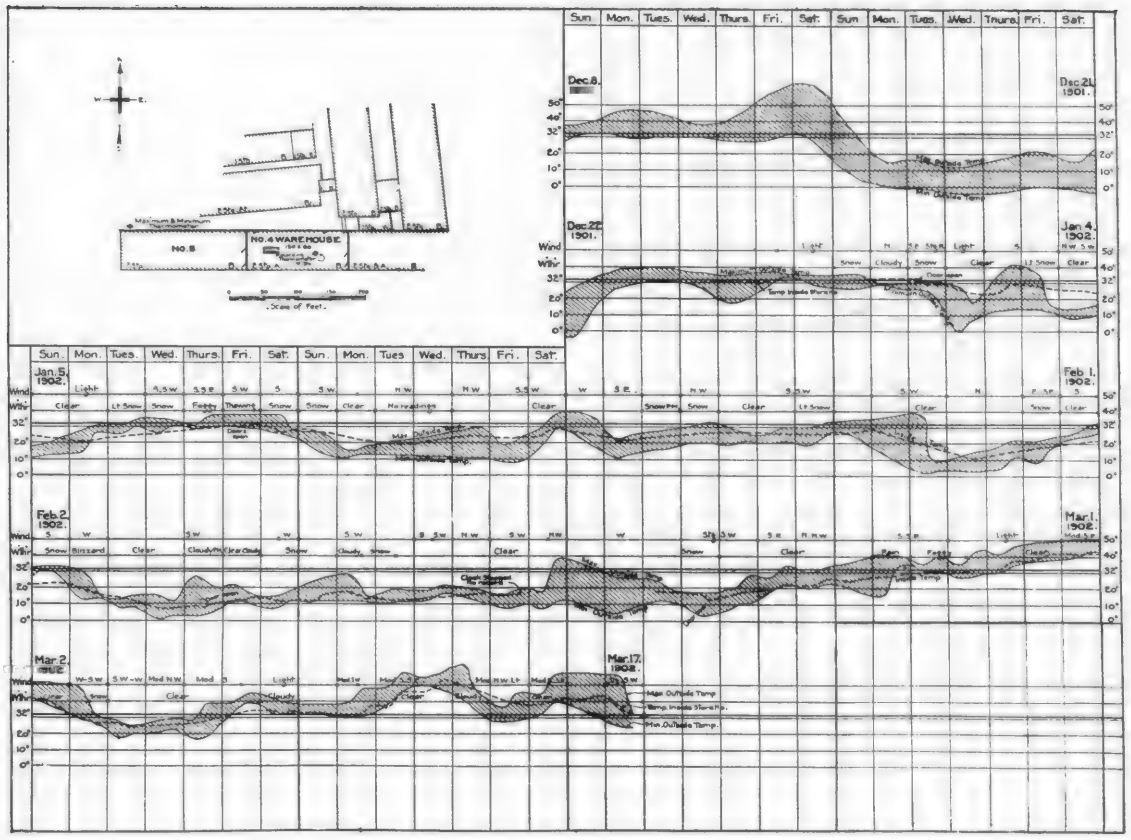


FIG. 3—RECORD OF TEMPERATURES AT UNHEATED STORE HOUSE OF JOHNSTON HARVESTER COMPANY

and this raised the question of the possibility of economically warming store houses just sufficiently to prevent freezing.

There was no question but that as a rule brick store houses could be warmed more easily and therefore at much less expense than those built of wood, but just what it would cost was not definitely known. This, therefore, became the subject of investigation, and in 1901 the matter was referred to the Inspection Department, which is the engineering bureau for the Mutual Companies, and the work was carried on under the author's direction.

Two methods of procedure presented themselves:

1. Apply certain formulæ previously developed by several eminent German engineers and frequently used in such cases;

2. Determine definitely by test the actual cost in one or more heated buildings.

In most calculations of heat required the normal inside temperature has usually been assumed to be about 70° F., varying from say 50° for rooms in which persons exercise vigorously to say 75° to 80° for such rooms as in hot-houses. However, in store houses it is only necessary to maintain the temperature a few degrees above freezing, and as there seemed to be but little data on record from actual tests of such buildings it was decided to make tests as there was opportunity.

DIFFERENCE BETWEEN TEMPERATURES INSIDE AND OUTSIDE OF STORE HOUSE

In 1901 we did not know of any heated store houses where a test could be made of the actual amount of steam required to keep the temperature in such buildings above freezing, say at 40° to 45° F., and therefore as a preliminary step a series of tests were carried on during the winter of 1901-1902 in several store houses in different parts of the country to determine the average difference between the outside and inside temperatures of unheated buildings when used in the ordinary way for store house purposes.

It was assumed that the temperature inside light wooden buildings would necessarily closely follow the outside temperature and therefore this class of building was not included in the test, but only those of brick in which an appreciably higher inside temperature might be expected. However, buildings of different sizes were chosen to see

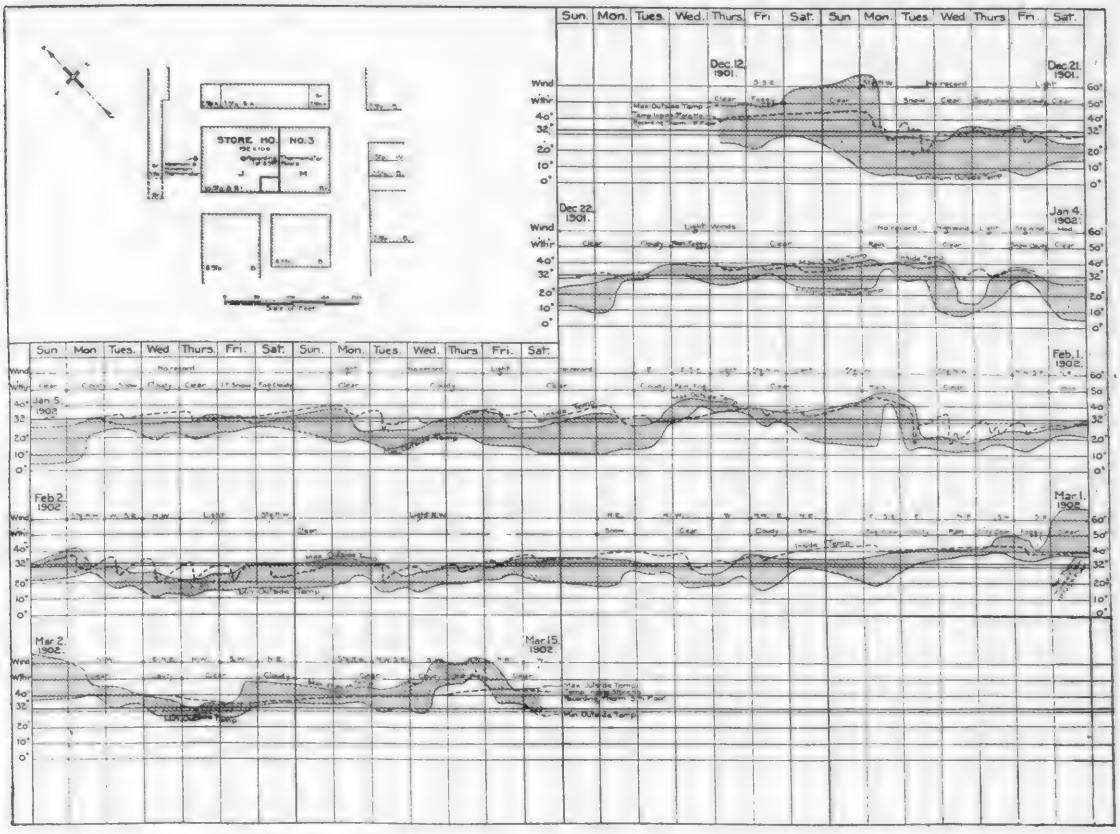


FIG. 4—RECORD OF TEMPERATURES AT UNHEATED STORE HOUSE OF HAMILTON MANUFACTURING COMPANY

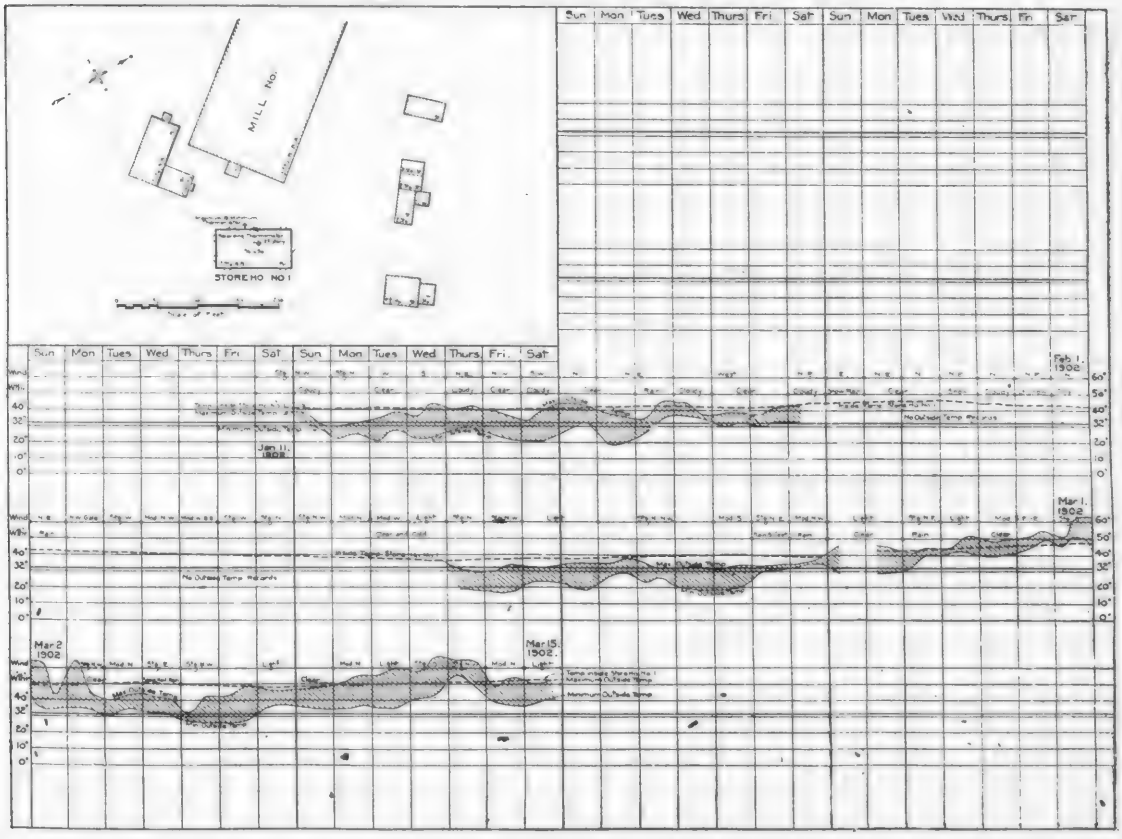


FIG. 5.—RECORD OF TEMPERATURES AT UNHEATED STORE HOUSE OF MT. VERNON-WOODBERRY COTTON DUCK COMPANY, MILLS 1 AND 3

what influence this item of cubical contents might have on the relative inside and outside temperatures, and by selecting store houses in different sections of the country a wide variation of weather conditions could be studied. With these points in mind the following mills were asked to coöperate in carrying on tests in buildings mentioned: Lewiston Bleachery & Dye Works, Lewiston, Me.; Nashua Manufacturing Company, Nashua, N. H.; Johnston Harvester Company, Batavia, N. Y.; Hamilton Manufacturing Company, Lowell, Mass.; Mount Vernon-Woodberry Cotton Duck Company, No. 1 Mill, Baltimore, Md. In every case the mill managements were very ready to give their assistance, and to them and to those men at the several plants who took the readings, were drawn for each store house, see Figs. 1, 2, 3, 4 and 5 inclusive, weather conditions being also indicated thereon. A plan of two properties in the vicinity of the store houses under tests is also given, showing roughly to what extent if any, the store house was shielded from the wind by the neighboring buildings.

These curves show that as a general rule:

1. The inside temperature changes gradually and does not follow the sudden temperature changes out of doors. The apparent rapid fall of the inside temperature shown in some of the houses generally took place during the forenoons and undoubtedly was due to the openings of the outside doors.

2. The inside temperatures were a

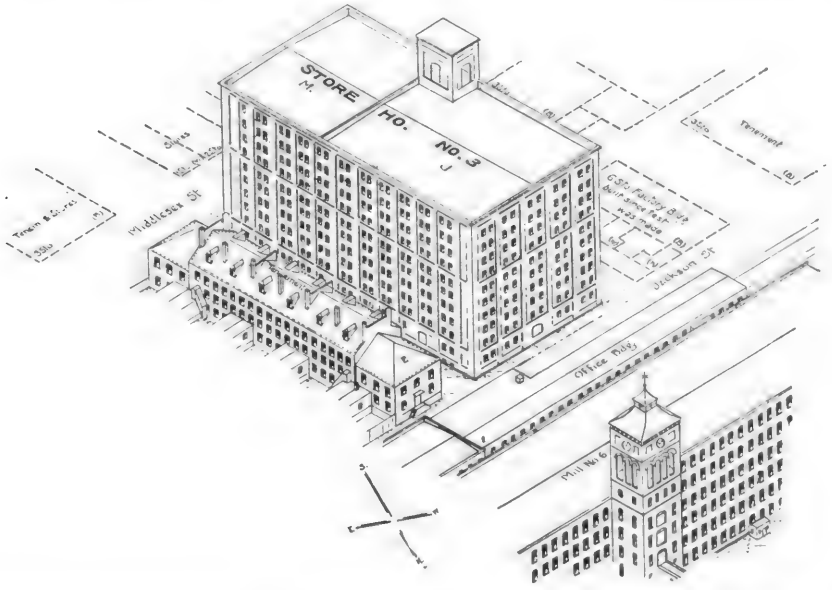


FIG. 6—STORE HOUSE NO. 3, HAMILTON MANUFACTURING COMPANY, LOWELL, MASS.

looked after the thermometers, and kept the records, the credit for the success of this part of the work is very largely due.

Each mill was sent a Draper recording thermometer to be hung inside the store house; a maximum and minimum thermometer to be placed out of doors near the building, and a dated, loose-leaf note book, in which was to be recorded (twice a day) the readings of the outside thermometer, direction and force of wind (light, moderate, strong), condition of weather (fair, cloudy, snow, rain), and approximately how much of the time the outside doors were open. The dial from each recording thermometer, giving a week's record of inside temperature, together with the leaves from the note book corresponding to that week, were returned weekly.

From this data temperature curves fairly good average of the outside temperatures. With but few exceptions, they never reach either the highest or the lowest outside readings, even when the outside conditions remain reasonably constant for a number of days.

It is to be noted that the temperature inside the brick store house at the Mt. Vernon-Woodberry Cotton Duck Co., Baltimore, Md., kept well above the freezing point throughout the winter.

TESTS OF STEAM-HEATED STORE HOUSES

During the summer of 1902 No. 3 store house of the Hamilton Manufacturing Co., of Lowell, Mass., in which temperature readings had been taken for the previous winter, was equipped with steam heating pipes, so that water could be kept on the sprinklers during the cold weather. This offered an opportunity to

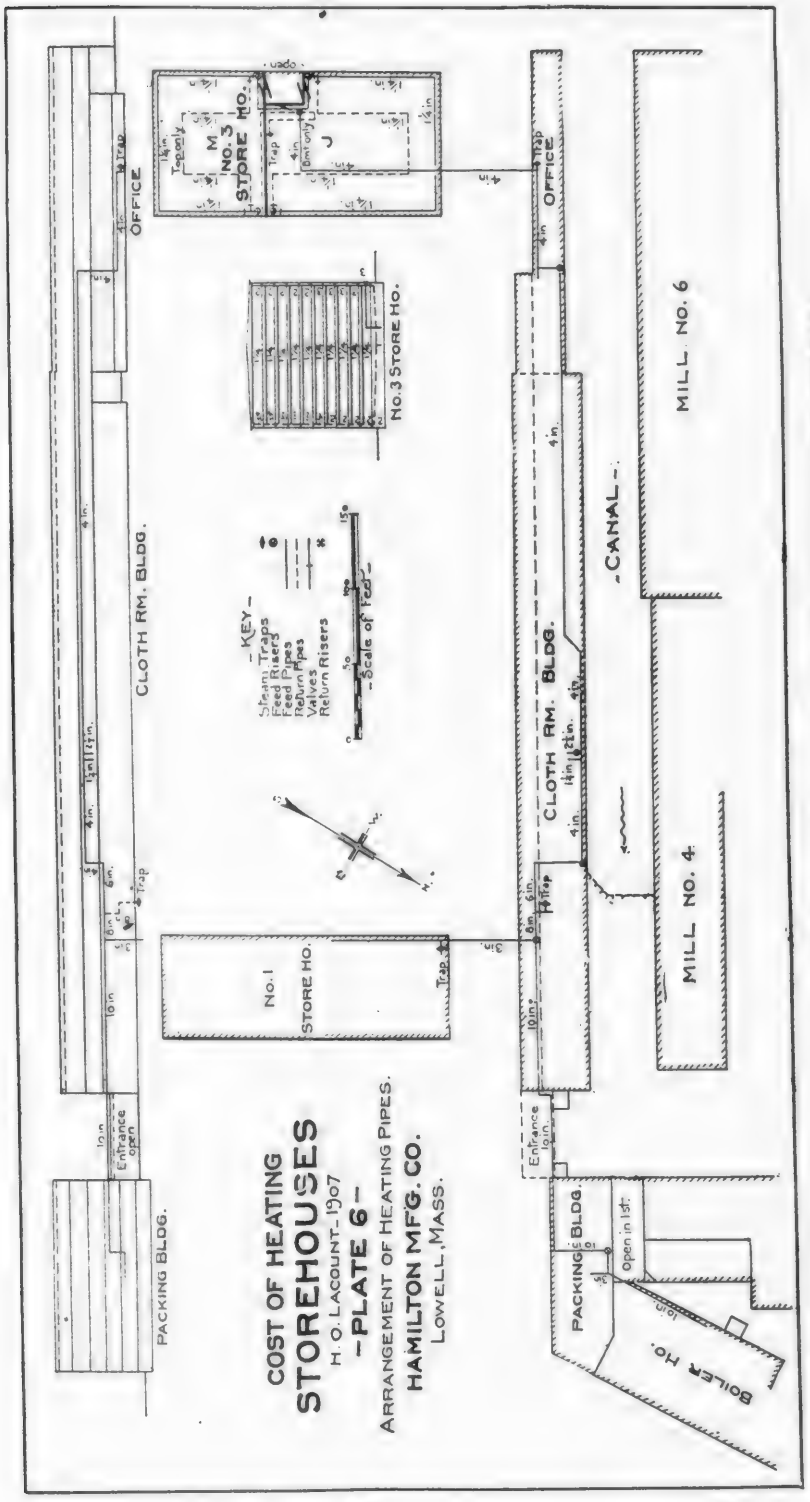


FIG. 7—ARRANGEMENT OF HEATING PIPES, HAMILTON MANUFACTURING COMPANY

determine the amount of steam necessary to keep the building warm, and the owners were entirely willing to have a test made, which was done in February, 1903.

About this time store house No. 22 of the Lewiston Bleachery & Dye Works, Lewiston, Me., in which temperature readings had also been taken during the winter of 1901-1902, was piped for steam, and during the summer of 1903 the large four-section store house A, of the Bates Manufacturing Co., Lewiston, Me., was built and also piped for steam heating. At the Androscoggin Mills, Lewiston, Me., the building known since 1903 as store house No. 6, was heated. These buildings gave additional opportunity to obtain data on the cost of heating, and in each case the owners readily consented to a test. Arrangements were therefore completed for tests in these three store houses in January, 1904.

DESCRIPTION OF BUILDINGS AND EQUIPMENT

Two of the above four store houses, namely, those of the Hamilton Mfg. Co. and Lewiston Bleachery & Dye Works, and their surroundings, also arrangement of steam pipes, are shown on Figs. 6, 7 and 8.

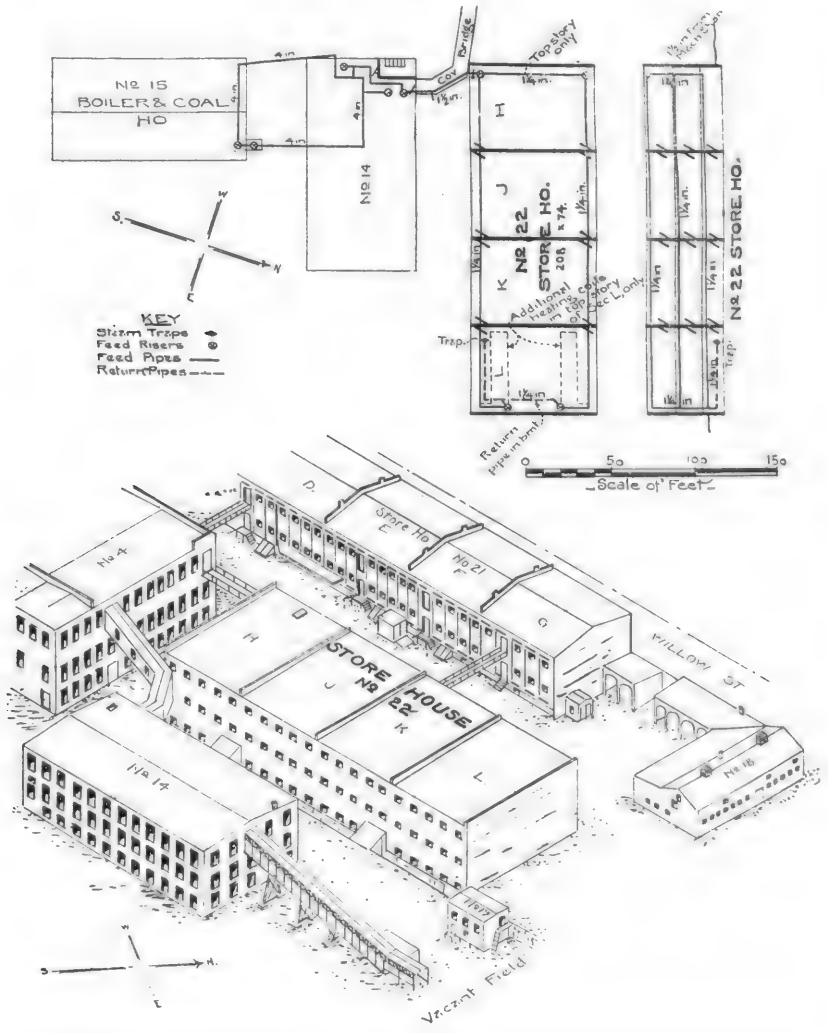


FIG. 8—STORE HOUSE NO. 22, LEWISTON BLEACHERY AND DYE WORKS LEWISTON, ME.

In working up the results of the tests on the four heated store houses, it has been of interest to note the difference or similarity, as the case might be, between the several buildings and their equipments, and to facilitate comparison, the following summary has been prepared in tabular form, giving in parallel columns certain data regarding size and construction of buildings, heating system, etc.

TABLE 1. SUMMARY OF DATA REGARDING HEATED STORE HOUSES

Items	Hamilton Mfg. St. H. No. 3	Lewiston Bl. and Dye Wks. St. H. No. 22	Bates Mf g. Co. St. H. "A"	Androscoggin Mills, St. H. No. 6
Location	One city block	Mill yard	Mill yard	Mill yard
City and State	Lowell, Mass.	Lewiston, Maine	Lewiston, Maine	Lewiston Maine
Walls				
Material	Brick	Brick	Brick	Wood
Thickness in inches	30 to 16	20 to 16	20 to 16	2½
Size				
Ground plan dimensions in feet	192 x 100	208 x 74	254 x 113	160 x 72
Height above ground in feet	90	38 (av.)	40 (av.)	13
Depth below ground in feet	5	4	6	0
Number of floors	10 & bsmt	2 & bsmt	4 & bsmt	1
Sections				
Number vertical	2	4	4	2
Size of each in feet	(117 x 100 75 x 100)	52 x 74	64 x 113	72 x 80
Doors through party walls	None	1 each sec.	None	1
Stair and elevator tower				
Size in feet	20 x 20	None	2–22 x 22	None
Outside or enclosed	Outside	None	Enclosed	None
Framing, etc.				
Plank and timber	Yes	Yes	Yes	Yes
Width of bays in feet	8	10	8	8
Floor beams in inches	14 x 16	5½ x 15 and 12 x 14	10 x 16	
Floor planks in inches	3	3	4	
Roof beams in inches	10 x 12	3–3 x 12	6 x 14	8 x 8
Roof planks in inches		3	4	2
Cubical contents				
Exclud. tower not heated in cu.ft.	1,786,000	646,464	1,275,764	149,760
Exclud. bsmt. and tower in cu. ft.	1,622,800	646,464	942,956	149,760
Per cent. bsmt. to total cu. ft.	9	26	26	0
Outside sur. exposed to cold in sq. ft.	75,360	36,824	56,028	16,616
Area of roof in sq. ft	19,200	15,392	28,702	11,520
Per cent. roof area to total area	26	42	51	69
Area of walls above ground exposed to cold in sq. ft	56,160	21,432	27,326	5,096
Windows				
Total number and kind	565 single	109 single	92 single	4 double
Glass area in sq. ft	3690	1207	1164	128
Avr. area per window in sq. ft	6.5	11.05	12.6	32.0
Per cent. glass area to wall area	6.5	5.6	4.7	2.5
Ratio glass area to cu. contents exclud. bsmt. and tower	1 to 440	1 to 396	1 to 810	1 to 117
Outside doors				
No. of	30	8	10	2
Estimated area in sq. ft	900	344	350	52
Per cent. door area to wall area	1.6	1.6	1.41	1.02
Ratio door area to cu. contents exclud. bsmt. and tower	1 to 1803	1 to 1878	1 to 2690	1 to 288
Per cent. total door and window area to wall area	8.15	7.23	5.54	3.54
Ratio total door and window area to cubic contents (exclud. bsmt. and tower)	1 to 354	1 to 416	1 to 623	1 to 830
Occupancy				
Sections contain	Mostly cotton in bales and cloth in cases	Bmt. chemicals and lumber 1 and 2 goods in cases	Bmt. mostly vacant, ¼ cotton baled and cased goods	Baled cotton
Warm opener room in bsmt. contains	7 openers	No room	Openers	No room

TABLE 1.—Continued

Items	Hamilton Mfg. Co. St. H. No. 3	Lewiston Bl. and Dye Wks. St. H. No. 22	Bates Mfg. Co. St. H. "A"	Androscoggin Mills. St. H. No. 6
Heating system				
Size of supply pipe in inches	3	1½	3	2
Size of circulating pipe in inches	1¼	1¼	1¼	1½
Length of circulating pipe in feet	6529	1500	5590	636
Total heating surface including risers and drips in sq. ft	3006	690	3730	316
Circulating pipe only sq. ft	2781	605	2877	316
Per cent. circulating pipe in top story	16.3	45	20.8	
Ratio heating surface in top story to area of roof	1 to 39	1 to 44	1 to 40	1 to 36
Ratio total heating surface to cu. contents exclud. tower	1 to 594	1 to 936	1 to 342	1 to 473
Ratio total heating surface to area of roof and walls (exposed to cold)	1 to 25	1 to 534	1 to 14	1 to 53
Per cent. of heating surface used in test	58	100	75	100
Steam				
Pressure at boilers	76	80	65	95
Pressure at st. h	50±	12 to 15	60 and 10	60
Pressure in st. h. system at reducing valve	1 to 2 (av.)	12 to 15	60 and 10	15 to 17 (av.)
Condition, general average	Superheated	Superheated	Primed	Superheated

METHOD OF TESTING

Except at the Hamilton store house, a short preliminary test was made in order to see that the conditions were favorable. This was then followed by the final test, the results of which are given later. The preliminary tests are not included in figuring the cost of steam used. This preliminary test was of value, especially at the Bates store house, in that it showed at once that more steam was being used than necessary, and consequently the steam pressure was reduced for the final test. The tests at the Androscoggin and Lewiston Bleachery store houses, which were started January 8, 1904, were discontinued owing to the sudden rise of outside temperature and the prospect of a few warm days. The readings taken, however, are also given.

The method of determining the amount of heat used in the buildings was substantially the same in all cases, and consisted in:

1. Noting pressure or temperature of the steam as it entered the system.
2. Determining the condition of the steam from time to time by calorimeter tests.
3. Weighing all condensed steam as it came from the heating pipes, night and day during the entire test.
4. Noting the temperature of the returned water.

From this data the British thermal units per hour used in heating the buildings could be found.

In addition temperature readings were taken about every four hours in different parts of the buildings. Outside temperature and weather conditions were also noted. Figs. 9 and 10 show graphically the results obtained from the readings at the Hamilton Mfg. Co. and Lewiston Bleachery Works.

At the bottom of each of these cuts is given a curve showing the British thermal units per hour used in heating the buildings. This curve was plotted as follows:

From the Tables of Saturated Steam by Cecil H. Peabody the Total Heat in B. T. U. of the steam at the pressure at which it entered the heating system was found; also, the heat of the liquid in B. T. U. corresponding to the temperature of the returned condensed steam. The heat of the liquid was then subtracted from the total heat, giving the amount of heat in B. T. U. used in warming the store house, per pound of steam. Multiplying this by the number of pounds of condensed steam per hour, gave the total number of heat in B. T. U. per hour consumed in the store house, as plotted.

During the tests the store houses were used in the usual way, and the steam was turned on and shut off by the mill employees as they had been accustomed to do, so that as far as the use of the buildings was concerned the conditions during the tests were in no way special and, therefore, were representative of the average service. At the Bates store house the preliminary tests showed that the buildings were being kept at an un-

necessarily high temperature, and a correspondingly excessive amount of steam was being used. In the final tests at this store house the steam pressure was reduced, as previously mentioned, with a view to keeping the temperature, say, between 40° and 45°, which practice was followed after the tests.

RESULTS OF TESTS

By referring to Figs. 9 and 10 it is evident that:

1. The temperature inside of each store house was quite uniform in the upper stories, but varied somewhat in the first story, due to the frequent opening of the outside doors for shipping.

2. The variation in the steam consumption corresponded roughly to the changes in the outside temperature.

Throughout three of the tests, namely, the Hamilton, Lewiston Bleachery and the Bates, a peculiar action of the steam traps was noted, viz.: the frequency of discharge varied widely and at more or less equal intervals, although the conditions in the store house changed only gradually, thus giving a very irregular apparent rate of condensation as shown on the curves. The points plotted show at each weighing of the barrel the pounds per hour, based on the length of time in which the barrel was filling. The irregular discharge was probably due to the traps not entirely freeing the system of water at each discharge, so that it gradually accumulated in the basement piping until the slight increase in head on the traps caused them to discharge more often, with the results mentioned. This would seem to be confirmed also by the curve of "temperature of condensed steam," in that while the traps were operating less often, the temperature of the water discharged was correspondingly lower, suggesting that it had been lying in the pipes longer than when the traps were discharging more frequently.

3. While the temperature of the condensed steam varied considerably in some of the tests, the average temperature was about 200° F.

4. Hamilton store house:

   a. The maximum variation of temperature in the first floor was from 32° to 50°, the lower temperature being only for a short time, apparently coincident with the opening of the large outside doors for shipping. In the upper floors, the temperature varied

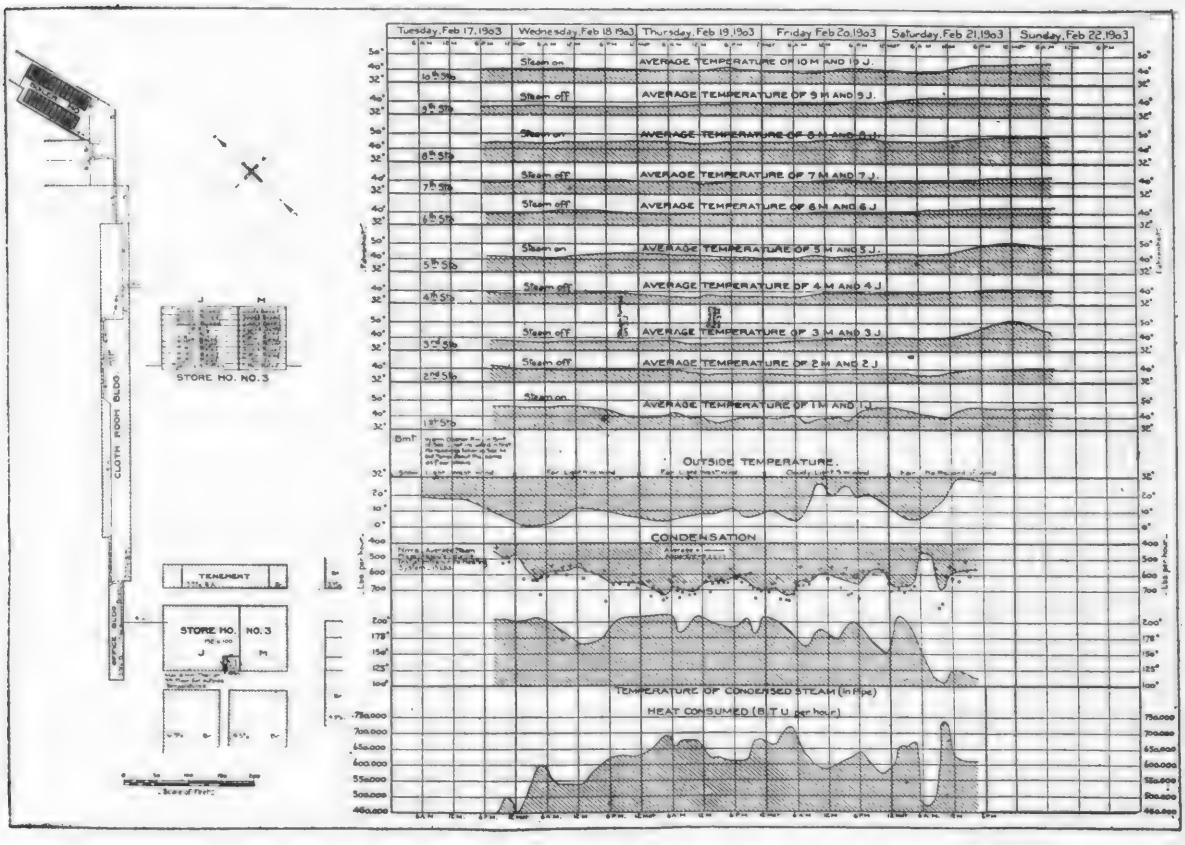

Tuesday, Feb 17, 1903
Wednesday, Feb 18 1903
Thursday, Feb 19, 1903
Friday Feb 20, 1903
Saturday, Feb 21, 1903
Sunday, Feb 22, 1903
AVERAGE TEMPERATURE OF 10 M AND 10 J.
AVERAGE TEMPERATURE OF 9 M AND 9 J.
AVERAGE TEMPERATURE OF 8 M AND 8 J.
AVERAGE TEMPERATURE OF 7 M AND 7 J.
AVERAGE TEMPERATURE OF 6 M AND 6 J
AVERAGE TEMPERATURE OF 5 M AND 5 J.
AVERAGE TEMPERATURE OF 4 M AND 4 J.
AVERAGE TEMPERATURE OF 3 M AND 3 J.
AVERAGE TEMPERATURE OF 2 M AND 2 J.
AVERAGE TEMPERATURE OF 1 M AND 1 J.
Steam on
Steam off
OUTSIDE TEMPERATURE.
CONDENSATION
TEMPERATURE OF CONDENSED STEAM (in Pipe)
HEAT CONSUMED (B.T.U. per hour)
STORE NO. NO. 3
TENEMENT
CLOTH ROOM BLDG
OFFICE BLDG

FIG. 9—CURVES SHOWING TEMPERATURES, STEAM AND HEAT CONSUMPTION, HAMILTON MANUFACTURING COMPANY

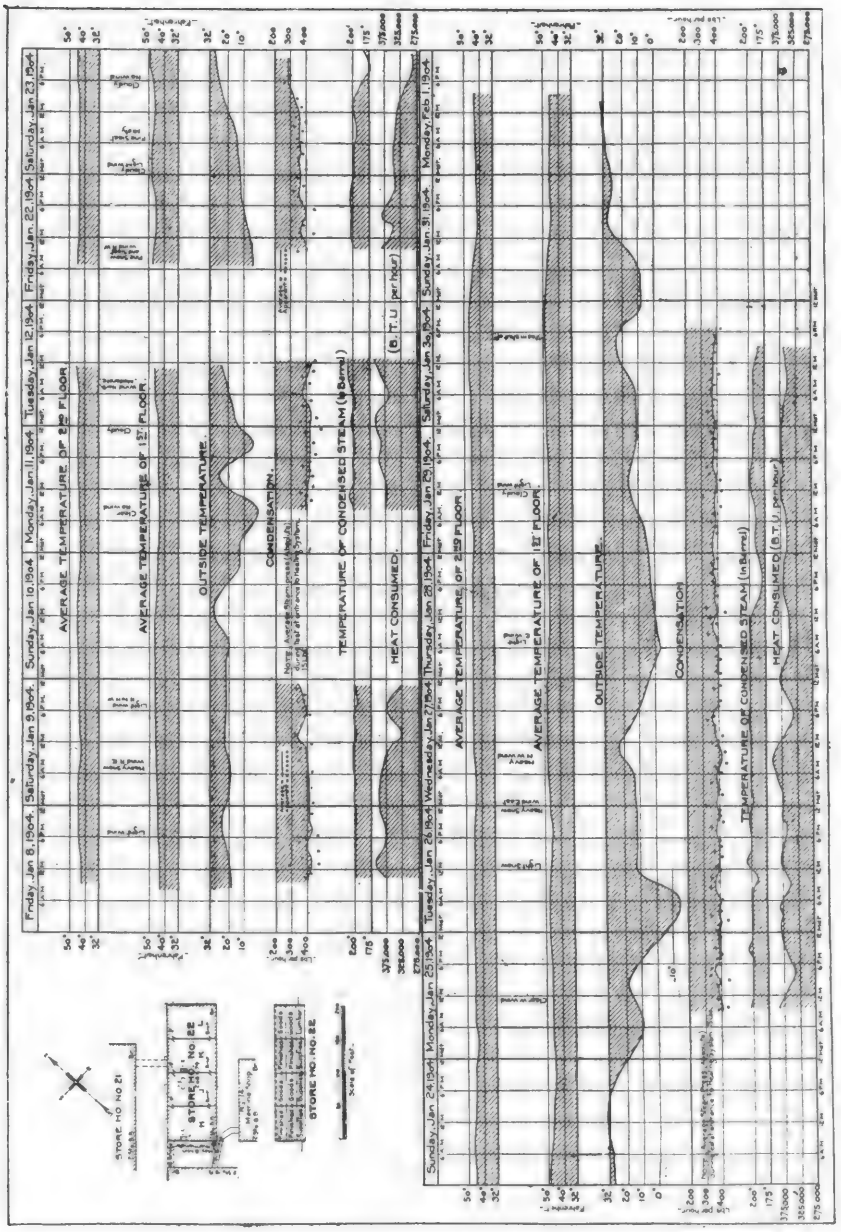


FIG. 10—CURVES SHOWING TEMPERATURES, STEAM AND HEAT CONSUMPTION, LEWISTON BLEACHERY AND DYE WORKS

from 34° to 51°, the higher temperature occurring several hours after a sudden rise of temperature out of doors.

b. The effect of cracks through the floors is clearly shown, in that alternate floors could be kept sufficiently warm without steam in those floors, although the temperatures were uniformly a few degrees lower in those floors than where the steam was in the pipes.

5. Lewiston Bleachery store house:

a. The maximum variation of temperature in the entire store house was from 37° to 59°.

These extremes do not show on the curve since only the average readings of a number of thermometers throughout the buildings are plotted.

6. Bates store house:

a. The maximum variation of temperature in the first floor was from 45° to 64°; and on the upper floor 37° to 58°.

b. With the store house tightly closed, as during the night and on Sunday, the building cooled very slowly. Therefore it had been the practice to keep the steam shut off during these times, but of course keeping watch of

TABLE 2. SUMMARY OF INSIDE AND OUTSIDE TEMPERATURES AND COST OF HEATING.

Items	Hamilton Mfg. Co. St. H. No. 3	Lewiston Bl. and Dye Wks. St. H. No. 22	Bates Mfg. Co. St. H. "A"	Androscoggin Mills. St. H. No. 6
Date of Test	1903 Feb. 17, a.m. to Feb. 21, m.	1904 Jan.25, p.m. to Jan.30,p.m.	1904 Feb. 2, a.m. to Feb. 5, m.	1904 Jan. 25, p.m. to Jan. 30, p.m.
Temperature (Degrees F.)				
Outside				
Average	12	14	7	14
Maximum	32	24	18	24
Minimum	1	−14	−4	−6
Inside (exc. warm basements)				
Average	41	47	48	49
Maximum	51	59	64	56
Minimum	32	37	43	41
Difference between average inside and outside	29	33	41	35
Average outside for coldest 24 consecutive hours during test	8	3	6½	6
Average inside for same period	40	46	47	49
Steam used				
Total consumption, pounds	56,929	49,282	70,096	20,007
Av. consumption per hr. pounds.	612	380	815	156
Average consumption per 24 hrs. pounds	14,688	9,120	19,560	3,744
Av. consumption per 24 hrs. per 1,000 cu.ft. of contents, pounds	8.06	14.2	14.8	25.1
Cost of heating				
Estimated first cost of steam pipe installed inc. trap and reducing valve, also 2 1¼ inch gates for each floor of each section. (30 cents per sq. ft. of heating surface)	$900	$210	$1,120	$95
Same per 1,000 cu. ft	$0.555	$0.325	$1.19	$0.634
Cost of steam to heat st. h. per 24 hrs (assume 8 pounds of water evaporated per pound of coal from and at 212 F., price of coal $4.25 per 2,000 pounds)	$3.90	$2.42	$5.20	$0.99
Cost of steam per 24 hours per 1000 cu. ft. of st. h	$0.0024	$0.0037	$0.0055	$0.0066
No. cu. ft. of st. h. heated per lb. of coal per 24 hours	884	566	385	319

Average cost of steam per 24 hours per 1,000 cu. ft. of store house for the above three brick buildings is $0.00386.

the inside temperature. The tests also show that the store house required several hours with the steam on to regain its normal condition.

c. With about 10 pounds steam pressure in the heating system night and day, the average temperature throughout the store house was substantially the same as when the steam was in the pipes during the day time only,—that is, from 6 A. M. to 6 P. M., but at 60 pounds pressure. It is also of special interest to note that under these conditions the steam consumption per 24 hours was about 35 per cent. greater with 60 pounds steam pressure during the days than with 10 pounds continually.

7. Androscoggin store house:

a. The rate of condensation in the heating system was quite uniform, notwithstanding the considerable variation of outside temperature and a comparatively uniform temperature in the heating.

Table 2 gives a summary of the inside and outside temperatures and the cost of heating for the period during which store houses were under test.

In order to determine the number of days of winter at Lowell and Lewiston during which the temperature is appreciably below freezing, the U. S. Government Weather Bureau reports for these cities were obtained for three consecutive years, and the maximum and minimum readings for each day of the winter months have been plotted and the readings for three seasons have been averaged. Similar charts have also been made from the Weather Bureau reports at the nearest Government station to the unheated store houses tested in the winter of 1901-1902, and also for a number of cities in the South, thus giving a general idea of the winter temperatures over a wide section of the country. The daily readings are plotted on Figs. 11 and 12, and the average temperatures for the three years for the winter months at these different localities are given in Table 3 following:

On these charts for Lowell and Lewiston, the period during which the store houses were under test is shown by double cross hatching. From these charts it is estimated that in Lowell, an average winter, including only that time during which the temperature is appreciably below 32° F., would be represented by 40 days similar to those during which the test was made at the Hamilton store house, and at Lewiston by 55 days similar to those during which the test was made at the Bates Manufacturing Company, and by 60 days similar to those during which the tests were made at the Lewiston Bleachery and Androscoggin Mills. Therefore, multiplying the cost per 24 hours obtained from the tests by the above constants, would give the cost for heating these four store houses per winter, as follows:

Hamilton Mfg. Co., No. 3 store house, Lowell, Mass.....	$156.00
Lewiston Bleachery & Dye Works, store house No. 22, Lewiston, Me	145.20
Bates Mfg. Co., store house A, Lewiston, Me.	286.00
Androscoggin Mills, No. 6 store house, Lewiston, Me.....	59.40

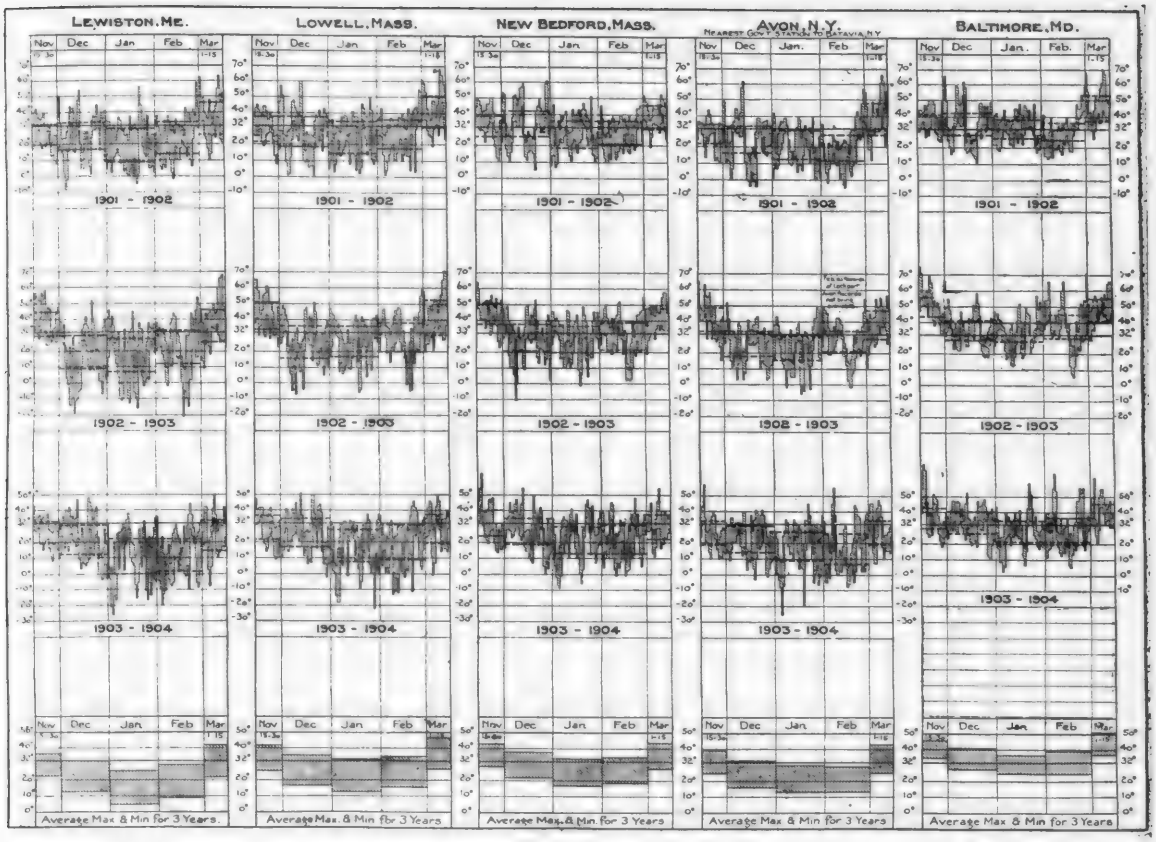
From the above it will be noted that

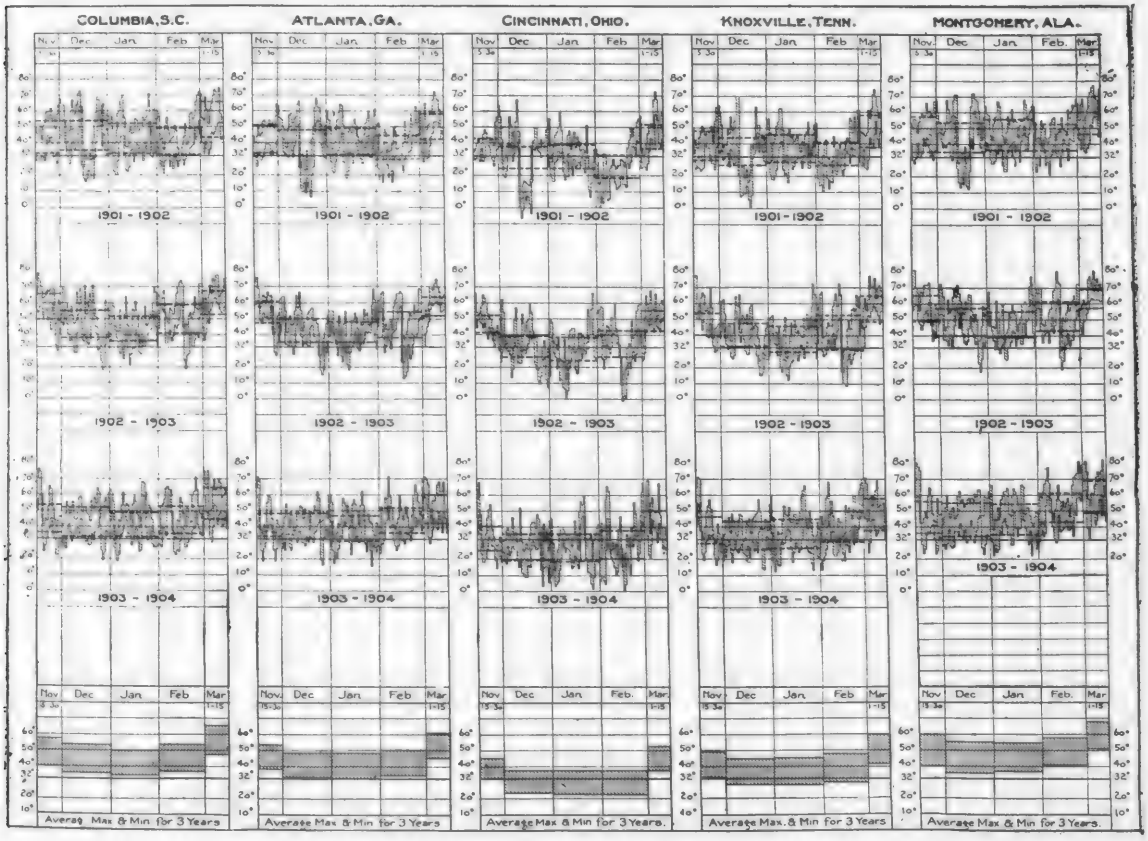
TABLE 3. AVERAGE TEMPERATURE OUT OF DOORS FOR THREE YEARS

November, 1901, to March, 1904

Taken from U. S. Government Records

Location	November 15–30		December		January		February		Mar. 1–15		Av'ge for Dec., Jan., Feb.		
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max. & Min.
Gardiner, Me	39	22	32	11	27	4	31	8	42	22	30	8	19.0
Lewiston, Me	37	23	32	13	26	5	30	9	42	22	29	9	19.0
Nashua, N. H	40	23	34	14	29	11	32	12	43	24	32	12	22.0
Avon, N. Y	39	25	33	16	30	13	29	13	43	25	31	14	22.5
Albany, N.Y	38	27	33	16	29	13	31	15	42	26	31	15	23.0
Lowell, Mass	42	26	36	17	33	13	35	16	47	27	35	15	25.0
Worcester, Mass	40	27	34	19	30	15	33	17	45	28	32	17	24.5
New Bedford, Mass	43	29	38	22	34	17	35	19	44	28	36	19	27.5
Baltimore, Md	46	35	41	28	37	25	39	25	51	37	39	26	32.5
Cincinnati, O	45	33	38	23	38	22	38	22	52	37	38	22	30.0
Richmond, Va	57	40	47	29	44	28	45	29	58	40	45	29	37.0
Knoxville, Tenn	49	33	45	28	45	28	48	30	60	41	46	29	37.5
Charlotte, N. C	53	37	48	32	46	31	49	33	61	43	48	32	40.0
Columbia, S. C	58	40	54	36	50	34	54	37	65	47	53	36	44.5
Atlanta, Ga	53	38	49	33	48	33	50	35	60	45	49	34	41.5
Montgomery, Ala	59	40	55	36	55	37	58	40	68	51	56	38	47.0





FIGS. 11 AND 12—TEMPERATURE RECORDS IN VARIOUS CITIES

the estimated costs for the Bates store house is considerably more than that for the Hamilton store house, although the latter building is appreciably larger. This is probably due to the more severe winter conditions in Lewiston and the fact that the inside temperature was kept at a higher point.

S. H. HOWE STORE HOUSE

The S. H. Howe Shoe Co., Marlboro, Mass., have a brick store house 100′ x 60′, two stories high with boiler house adjoining. This was equipped with a steam heating system and a record kept of the amount of coal used for the winter of 1901-1902. The inside temperature, registered by a recording thermometer, seldom got below 60° F., and during the night ran as high as 90°. During the winter 89 tons of coal were burned in heating, giving, at $4.25 per ton, the cost of steam for the winter as $378.

As the inside temperature was kept much higher than necessary to prevent freezing, this figure is not comparable with those given in the tests for the four store houses above. It is, however, of special interest, as giving some idea of the increased cost where a building is kept at these high temperatures. The Hamilton store house, for example, was about eleven times the cubical contents of the Howe building, so that the cost of heating the Shoe Company's store house per 1,000 cubic feet of contents was 26 times that for the Hamilton, assuming as above $156 for cost of heating the Hamilton per year.

PEPPERELL STORE HOUSE

The Pepperell Manufacturing Company, Biddeford, Maine, have a one-story and basement brick store house, about 150 ft. in length and 60 ft. in width at one end by 20 ft. at the other. During the winter of 1904-1905 they kept a careful record of the amount of steam used in heating by weighing the return water, and estimated that 13 ton of coal were required for the season to keep the temperature in the store house between about 40° to 45° F. This would make the cost, at $4.25 per ton, $55. This building has a cubical content of 97,000 cubic feet, so that store house A of the Bates Mfg. Co. was about 9½ times as large. On a basis of $286 per year to heat the Bates store house, the cost to heat the Pepperell store house per 1,000 cubic feet is nearly twice as much. This may be explained in part by the fact that the Pepperell store house was much smaller and the ratio of roof and wall area to cubical contents considerably greater than at the Bates.

ESTIMATED B. T. U., USING GERMAN FORMULAE

Having obtained definite information regarding the amount of heat necessary to keep these store houses at the desired temperature, it has been of interest to apply the formulæ mentioned in the first part of the paper and compare the actual with the estimated cost. The heat required for each of the four store houses under the conditions of the tests (see Tables 1 and 2) has therefore been estimated using formula $H = k\ (t_1 - t_0)\ S$ and constants as clearly described by Professor J. H. Kinealy, Washington University, St. Louis, in a useful little book entitled "Formulæ and Tables for Heating," in which are briefly given the results of careful experiments and the study of the subject by well known German investigators.

$$H = k\ (t_1 - t_0)\ S$$

H = British thermal units per hour. k = constant, value being as given in "Formulæ and Tables for Heating." t_1 = average inside temperature. t_0 = average outside temperature. S = area of cooling surface in square feet.

TABLE 4

Store House	B.T.U. per hr. by Formula	B.T.U. per hr. by Test	Per cent. difference
Hamilton Mfg. Co., st. h. No. 3.....	620,000	626,000	0.97
Lewiston Bleachery, st. h. No. 22.....	373,000	369,000	−1.6
Bates Mfg. Co. st. h. "A".....	682,000	800,000	17.3
Androscoggin Mills, st. h. No. 6.....	151,000	148,000	−2.0

Applying this formula to the store houses in question gives results shown in Table 4, where are also given for purposes of comparison the figures obtained from the tests.

In the case of the Hamilton and Bates store houses the figures given by the formula were increased 10 per cent. on account of exposure and for the Bates store house a further increase of 5 per cent. was made because of the unusually high wind which prevailed during a considerable part of the test.

Table 4 is of special interest as showing how accurately the required heat may be calculated, and the author finds peculiar satisfaction in this close check between the estimated and the actual results, believing that the work here described will still further increase the confidence of engineers in the results obtained from using the formula and constants mentioned.

In the case of the Bates store house it may be that the outside shipping doors were open more of the time than was noticed, so that a special allowance for this should have been made when ap-

plying the formula. If so, this would account for at least a part of the difference between the estimated and actual results.

Tightness of walls and windows, meaning ability to keep out cold winds, has a large effect on inside temperatures and the cost of heating. In the Southern States no heating would be necessary ordinarily in well-built store houses of brick and probably of wood, if some special care were taken to make the walls non-conducting and tight, and it is probable that a moderate amount of mason and carpenter work in stopping cracks and making doors and windows fit more tightly would make heating unnecessary in many store houses in these warmer sections.

Flow of Superheated Steam in Pipes*

By E. H. Foster

It is somewhat surprising that with the great number of installations which have been in practical operation there should be so little exact data available as to the flow of superheated steam in pipes. The lack of this information which is so much sought after is doubtless due to the fact that plants are usually constructed on a working basis and not for experiment. As an example, a battery of boilers all fitted with superheaters will deliver steam into a common header or equalizing pipe out of which steam will be taken at various points for the engines which are being served by the boilers. This usual condition of power-plant piping permits a free exchange of surplus steam back and forth, according to the demands, and throws such a cloud of uncertainty over the actual velocities of the steam in the various pipes as to effectually thwart any attempt to get a correct accounting for the cause of any decrease in temperature or pressure. Also at various plants the insulating covering differs perceptibly, both in character and thickness. Occasionally, however, a situation is found where there is a run of pipe with a known quantity of steam passing through from which data may be obtained to throw light on the laws governing the flow of steam. From quite a large number of plants we have been able to collect enough data to indicate that the laws governing the flow of superheated steam differ appreciably from those governing the flow of saturated steam. A few general conclusions have been reached as follows:

1. That the rate of heat transfer per degree difference in temperature per square foot of surface per hour increases with the steam velocity.

2. That this increase is more rapid in small than in large pipes.

3. That the percentage loss in heat decreases with the velocity, notwithstanding the rising rate of heat transfer.

A high velocity of superheated steam in pipes is therefore recommended, because there is a smaller percentage of heat losses and because there is a lower actual drop in steam temperature.

The data at hand, while ample to show that the above conclusions are true, have not as yet been arranged sufficiently in detail to allow a formulation of the general law. It would be necessary to have a series of tests, conducted on a large scale, and on different sizes of pipe all covered in a uniform manner, in order to establish a formula covering the actual loss of temperature and pressure by superheated steam at different velocities.

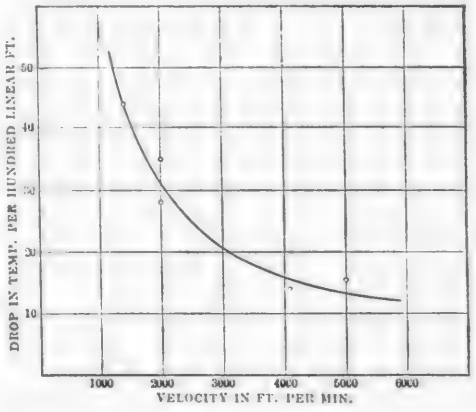


FIG. 1—VARIATION IN DROP IN TEMPERATURE IN SUPERHEATED STEAM LINES, WITH VELOCITY

Our practice is to recommend for steam pipes of straight runs or easy bends a velocity of 6,000 to 8,000 feet per minute where a superheat of from 100 degrees to 200 degrees F. is used, and we have found these proportions to give very satisfactory results.

To substantiate the foregoing conclusions, the writer offers a few curves which have been constructed from a mass of notes which have been collected from time to time; also a set of curves taken from a very excellent and complete paper read by Mr. O. Berner be-

*Presented at the Indianapolis, Ind., meeting (May, 1907) of The American Society of Mechanical Engineers, and to form part of Volume 28 of the Transactions.

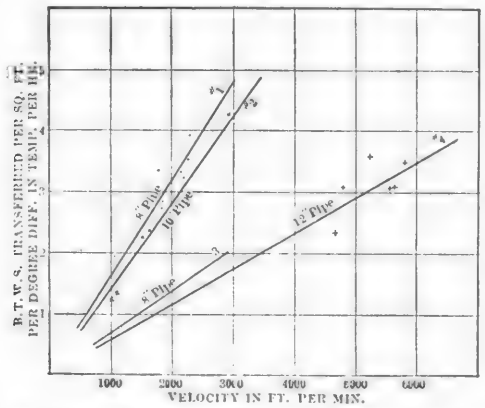


FIG. 2—VARIATION IN HEAT TRANSFER IN STEAM PIPES, WITH VELOCITY

fore the German Society of Engineers in Berlin, published in their Transactions of 1904.

This table is also given after being converted into English units. It is expected that these figures will be materially revised from time to time, as more complete data on the various subjects are available.

TABLE I

Loss in Temperature in Degrees F. for 100 Feet of Pipe. (O. Berner.)

Average steam pressure, 176.5 lbs.

Average steam temperature, 482° F. 105° superheat.

Diam. pipe, inches	Velocity of steam in feet per minute		
	1968	3936	5904
3.937	50.3°	25.5°	16.45°
7.874	25.5°	12.7°	8.23°
11.811	17.0°	8.23°	5.49°
15.748	12.6°	6.07°	4.39°

Fig. 1 shows the rate at which the drop in temperature per hundred feet of lineal feet of pipe decreases as velocity of steam increases, and is approximately correct for pipes from 6 to 10 inches in diameter.

Fig. 2 shows that the variation in rate of transfer of heat units per square foot of degree difference in temperature per hour increases almost directly with the velocity of the steam in the pipe, and varies for the different sizes of pipes and different kinds of covering. In pipes Nos. 1 and 2 a good magnesia covering was used; in No. 3, Keasbey magnesia, standard thickness, and in No. 4, magnesia 1⅛ inch.

Fig. 3 is a convenient diagram to show the required cross sectional area of a pipe passing 1,000 pounds of steam per hour at velocities of 6,000, 8,000 and 10,000 feet per minute and at different temperatures and pressures.

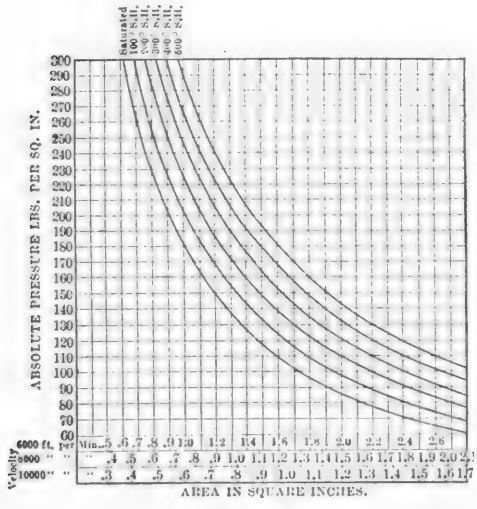


FIG. 3

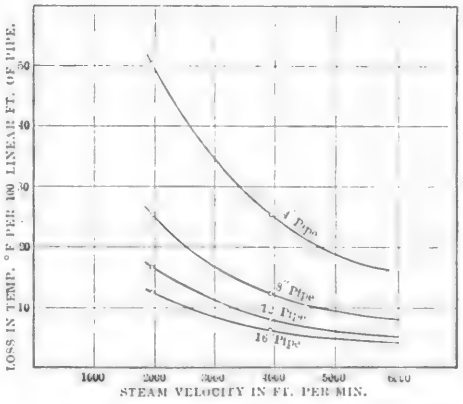


FIG. 4—LOSS OF TEMPERATURE IN SUPERHEATED STEAM LINES, VARYING WITH SIZE OF TYPE AND VELOCITY OF STEAM

Fig. 4 is a curve constructed from figures given by Mr. O. Berner.

Modern Science Club

Among the recent lectures before the Modern Science Club, Brooklyn, meeting weekly on Tuesday evenings, were the following: "Condensers and Condensing Equipment," by A. A. Adler; "Rating of House Heating Boilers by Evaporation Tests," by G. A. Fromm, and a lecture on "Steam Turbines." In his lecture on the rating of house heating boilers Mr. Fromm discussed the methods adopted at the Buffalo plant of the American Radiator Company. In making the tests the total amount of water supplied to the boiler during a stated time was weighed, from which was deducted the weight of the water remaining in the boiler at the end of the test. This amount, divided by the number of hours of the test, gave the average hourly evaporation, which was the basis for estimating the rating of the boiler.

Materials for the Control of Superheated Steam*

M. W. KELLOGG

Since the introduction of superheated steam as a large factor in economy in stationery power plant use, the question of what type of material is best for the proper controlling of the resulting high temperatures has caused a great deal of investigation and interest.

In the following discussion of materials, some reasons will be given which are the results of experience and test, and other facts which we have accumulated from reliable sources will be shown. This article treats particularly of what might be called in a general way Piping Systems, which systems are made up of pipe, fittings, valves, and the necessary details connected therewith, such as joints, gaskets, etc., and are taken up separately.

PIPE

There can be little question as to the matter of pipe except quality. Of course, welded wrought iron or steel pipe is successful, but the difference in the quality of pipe under different conditions is very material. As in nearly all instances in a superheated steam station the old-fashioned screwed joint is not satisfactory, it is necessary to do what is termed "work" the pipe—that is, weld, van stone, etc.—to make either a welded, van stone, or other joint of the same general description.

For this work, the pipe made from open hearth steel is a great deal the best for manufacturing reasons, because it can be properly 'worked," there being less carbon, and the quality is much more uniform. Bessemer steel pipe will very often act in a satisfactory manner, but one is never sure that Bessemer will run even and, therefore, troubles may result.

It is practically impossible to "work" wrought-iron pipe. In making what is known as a "van stone joint," the pipe is nearly sure to split very badly, not only at the weld, but all around its outer circumference.

Nearly opposite qualities from those used for getting good results from "working" pipe are required for threading. A good quality of wrought iron will cut and thread more easily with standard pipe machines and standard dies than a steel pipe, and a Bessemer steel pipe will thread much more easily with standard dies than open hearth.

A great many manufacturers have difficulties in threading open hearth steel pipe, for the reason that they set the dies exactly the same as if they were cutting other qualities. This causes ripping of the threads, etc. The die in a pipe machine should be set at a greater angle, with the radius of the pipe passing through the point of contact of the die for soft steel, than it would be for other kinds, and this in itself will very often eliminate great troubles in this line. The question of lubrication, etc., is also important in this particular.

The ordinary commercial pipe will stand more pressure than the average person believes. A standard 1-inch piece of welded pipe will usually not break under 1600 pounds per square inch hydraulic pressure.

Full-weight pipe I believe to be perfectly suitable for any temperature and any working pressure up to 225 or 250 pounds, as long as it is not thinned at any point by cutting and threading.

FITTINGS

The design of fittings as generally manufactured for the different purposes are, in a general way, very satisfactory, with the one exception, that very few manufacturers on their standard articles include what is known as the "long fillet" between the body of the fitting and the flange. This is a very desirable point, due to the fact that at this place there

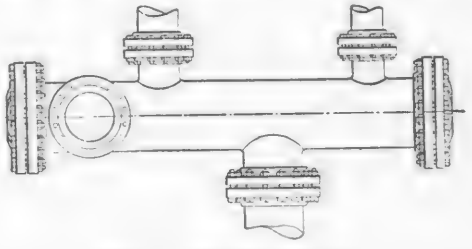


FIG. 1—WELDED WORK

is the greatest strain from shrinkage in the molds, which also tends to develop porous spots. Most large users of this type of material have learned this thoroughly and design their fittings specially; the chief difference in their design from that of the general manufacturer merely covering this point. The quality of the material in fittings, however, is a very important thing in connection with superheated steam.

The latest practice is to do away with fittings entirely on high-pressure steam lines and put what are known as "nozzles" on the piping itself. This is accomplished by welding wrought-steel pipe on the side of another section, so as to accomplish the same result as a fitting. In this way rolled or cast-steel flanges and a van stone or welded joint can be used. This method has three distinct advantages, to wit:

1. The quality of the metal used, for

*Presented at the Indianapolis Meeting (May, 1907) of The American Society of Mechanical Engineers, and to form part of Volume 28 of The Transactions.

reasons explained hereafter when the subject of the effect of heat on metals is taken up.

2. The lightening of the entire work.

3. The doing away with a great many joints.

As a general average, at least 50 per cent. of the joints can be left out, and sometimes this proportion runs up as high as 60 or 70 per cent., according to the layout of the system.

If this method is employed, substantial welds must be made, not only to stand the pressures required, but also the strains; this is accomplished successfully in Germany, England, and the United States.

VALVES

It is important to have a good design of valve. I believe that nearly any of the designs made by the good manufacturers are entirely suitable; such as a broken or solid wedge valve of the ordinary type, under the condition that all machine work is done thoroughly and the quality of metal used is satisfactory for the purpose intended.

It may be interesting to note here the effect of a large range of temperatures on a short piece of steel. By calculation, a piece of steel six inches long, heated 500°, will expand 0.019 inch. This figure is put down to show how variations in the coefficient of expansion of metals by heat have a large effect on the permanency of a valve staying tight, and it can readily be seen that a small proportion of the distance given is sufficient to cause trouble.

METALS

I find that different authorities vary slightly in their statement as to what temperatures different metals will stand with good results. German authorities state that cast iron should not be used above 480° F. Other authorities allow us to go as high as 575° F. Above these temperatures in cast iron the limit of elasticity is reached with a pressure varying from 140 to 175 pounds. Under such conditions the material is strained and does not resume its former shape, and eventually shows surface cracks, which continue to grow until it lets go. These temperatures and pressures also lead in time to a shrinkage of all parts, and to structural alteration of the metal, which results in leakages in valves at the seatings. Therefore, it would seem that iron castings are unsuitable for both fittings and valves to be used in any superheated steam work. While they may last for some time, after a few years' use the metal becomes very weak and some cast iron has reached the point in weakness where if it were merely tapped lightly with a hammer it would break into pieces.

The only adaptable metal I believe to be cast steel. The results of tests by Bach on this metal for the effect of temperature are such that at 572° F., the reduction in breaking strength only amounts to about 1.1 per cent. and at 752° F. to about 7.8 per cent. Therefore, it seems that this metal is practically capable of withstanding all pressures and temperatures up to at least 800° F., without showing any appreciable weakness.

The influences of high temperatures on bronze, etc., is very material. At ordinary temperatures this metal has a breaking strength of about 34,100 pounds per square inch and an elongation of 36 per cent. At 572° F. the breaking strength falls to about 19,500 pounds per square inch and the elongation to 11.5 per cent. At 662° F., which is quite a common temperature, as it leaves the superheaters, the breaking strength of bronze only amounts to 12,200 pounds per square inch and the elongation at the breaking point is only approximately 1¾ per cent. This seems to eliminate entirely brass or bronze of ordinary composition for use with highly superheated steam.

The effect of temperature on nickel is very similar to that of cast steel and in consequence this material is very suitable for use in connection with highly superheated steam. Bach recommends that bronze alloys be done away with for use on steam lines above a temperature of about 390° F. Even neglecting the special quality of nickel seatings, on account of the great toughness of this metal and the methods which can be used for securing rings of this substance to the valves and conical surfaces, it has the special advantage of having the coefficient of contraction and expansion with temperature almost exactly the same as that of cast steel, so that no slackness of the rings occurs and the valves remain absolutely steam tight. There are instances in which valves constructed with nickel seatings have been satisfactorily used with steam temperatures up as high as 932° F.

Seats, discs, and bushings made of brass or plain bronze do not retain their shape.

For spindles on superheated steam work I strongly recommend nickel steel, which holds its shape and does not deteriorate with high temperatures.

Seatings in valves should not only be screwed in, but also pinned in addition, using a fine thread which is very long, to give a tight joint. Seats should also have a flange on the top that makes a joint with the body when screwed down, which prevents the tendency to leak through.

JOINTS

I think it is generally acknowledged that the old-fashioned screwed joint, no matter how well made, would not be suitable for superheated steam work. This leaves for discussion two general types, viz.: welded joints, and what are

generally known as van stone or climax joints; that is, any joint where the pipe is turned over the face of the flanges.

In welding a flange on a piece of pipe, great care must be taken to see that the weld is perfect, because of the unequal thicknesses of the metals to be so welded. If the weld is thoroughly made, this type of joint is very good, although for erection purposes, due to the fact that the flanges cannot swivel, it does not equal the turned-over joint as mentioned above. The manufacturing expenses in making a welded joint are also much more for the same type of work accomplished, on account of the necessity of doing all finishing work after all rough work, such as welding and bending, has been completed. Therefore, the cost of welded joints is greater, not only for the work done, but because of the increased expense in finishing on account of the necessity of employing methods different from those where the flanges, etc., were all finished before the joints were made, as is possible on the turned-over joint mentioned above.

In regard to the turned-over or van stone joint, the quality of its manufacture seems to us the most important feature. This joint can be made in a careless way where the pipe is in no way thickened up and only faced on the front. A joint of this kind does not give good results, principally for two reasons:

1. The thinness of the metal on the turned-over portion; and

2. On account of the recess left between the back of the pipe on the turned-over portion and the flange, due to the pipe not being finished at this point.

The writer believes, however, if this joint is properly made, it is equal to the welded joint as a manufactured article and superior to the welded joint as an article for erection.

To have this type well made, the pipe on the end should be thickened up in an amount sufficient so that after the joint is turned over there will be enough metal left to face the turned-over portion on the front, on the outer edge, and on the back. We, of course, take for granted that the flanges are finished on the front. After the work above mentioned is done, the pipe should be as thick on the turned-over portion as the original thickness, or very close to it. Increasing the thickness of the pipe on the end before going through the operation is done in several ways. In a general way, I consider any of the methods satisfactory. The point made of facing the turned-over portion of the pipe on the back is as exceedingly important one, much more so than most people seem to realize. I have known instances where it has been found impossible to make a ground joint, for no other reason.

In reference to making up a joint, I believe that the face of all flanges or pipe where a joint should be made ought to be given a fine tool finish and have the face level, and then use a gasket of some description. A perfectly made ground joint is a good thing, but it is very expensive, and it is hard to get the average contractor to furnish it in a perfectly workmanlike manner. Also, after it is so done, it is liable not to stay tight, on account of the tremendous expansion and contraction causing such strains that the joints are liable to open up, particularly when the pressure is taken off the plant. The simple expansion and contraction on the bolts that make up a joint would cause this.

GASKETS

There are large numbers of gaskets manufactured of all types and descriptions. It is very hard to take up this subject and be fair to each of the manufacturers, for the reason that practically no one can and has had experience with every type made to judge for himself, and hearsay would lead us to suppose that all of them are at one time perfect and at other times useless.

I have used a great many different types of gaskets, however, and have obtained the best results with a corrugated soft Swedish steel gasket with "Smooth-on" applied, and with the McKim gasket, which is of copper or bronze surrounding asbestos. The ordinary corrugated copper gasket is a very popular make and has been used a great deal. On superheated steam, usually sad results follow. There seems to be some peculiar action that causes this, as on superheated steam lines a corrugated copper gasket will in time pit out in some part of the flange nearly through the entire gasket. I have heard a great many reasons given for the cause, such as electrical action, disintegration, etc.

The wear of a gasket depends largely on the method of pulling up bolts on flanges. In fact, I believe that a great many troubles have occurred because of imperfect erection. If joints are pulled up entirely on one side and left loose on the other, and then taken up on that side, trouble with the gasket is almost certain. The bolts should be taken up gradually all around the flange. The experience of the erecting crews on high-class superheated steam lines is an exceedingly important thing. The average steam fitter is not suited to this type of work. He has had experience with lower pressures and less important tasks and after a piece of work is erected by him it is customary to find a great many leaks which are usually only eradicated after the whole joint has been broken and properly repaired. All these troubles can be eliminated by using only steam fitters experienced in the type of work under consideration.

THE HEATING AND VENTILATING MAGAZINE

PUBLISHED MONTHLY AT
1123 BROADWAY, NEW YORK
BY THE
HEATING AND VENTILATING MAGAZINE CO.

A. S. ARMAGNAC, EDITOR

European Representative:
AMERICAN PUBLICATION BUREAU, 31, Overton Road, Leicester, England

Subscription, - - - - -	$1.00 per year
Foreign countries, - - - -	1.50 " "

Manuscripts submitted for publication must in every case be accompanied by postage; otherwise they will not be returned.

QUITE the most important action taken at the recent convention of the National Association of Master Steam and Hot Water Fitters was the passage of the resolution urging members to make use of the so-called stamped order by which the replacement of defective parts is made a condition of the order. The wording of the resolution is: "That this association recommends to the members that they use the rubber stamp in placing their orders for steam fitting material."

This for the first time places the national association squarely on record as officially favoring the policy of the "rubber stamp." Heretofore it has been distinctly understood that the stamped order was a matter that had not as yet received the endorsement of the national organization and that its use was optional with the various local associations.

It is unfortunate, in some respects, that a wider representation of the membership and of the steam fitting fraternity at large was not present at the time this important matter came up for decision, as the action, irrespective of whether or not it would have been the same were a larger vote had upon it, is bound to be lacking to some extent in moral, if not in legal, authority.

Meanwhile the manufacturers have taken what is really a decisive step in holding a meeting during the master steam fitters' convention and, after a conference with the master fitters, declining to acquiesce in the matter of the stamped order. Thus the issue has been made a clear one and further developments will be watched with interest.

HOW wide a difference is there between the amount of increase in the cost of raw materials used by manufacturers of steam fitting and plumbing supplies and the amount of increase in the selling price of the finished product, as compared with the situation two years ago? This question, briefly stated, is one that has been put to a number of manufacturers by our contemporary, *Domestic Engineering*, and judging from the general agreement of the replies obtained, they may be taken as fairly conclusive. The main fact brought out by the investigation is, that while the prices of raw materials have steadily advanced, in some cases over 50 per cent. above what they were two years ago, the selling prices have in no case risen correspondingly. In a typical instance, the increase in the cost of raw material during that time was 21 per cent. to 25 per cent., while the average increase in the selling price was not over 7½ per cent.

The facts brought out by the investigation would seem to indicate the prospect of a further rise in the price of steam fitting supplies, even though the cost of raw materials remained where it is at present.

THE increasing importance of a fuller knowledge of outside weather conditions in connection with modern heating work is emphasized in the series of tests reported by Mr. H. O. Lacount in his recent paper read last month before the American Society of Mechanical Engineers and published on another page of this issue. The paper is entitled, "Cost of Heating Storehouses," but its most interesting portion to many will be the record of indoor and outdoor temperatures at the points where the storehouses are located, the indoor records being taken at times when the storehouses were not heated. In addition to this information, there are a number of weather charts, showing the temperature variations in cities other than those from which we have received reports, this information supplementing, to a remarkable degree, the data on the same subject which has been presented recently in these columns.

A PROPOSITION that stationary boilers ought to be made to do from ten to twenty times as much work per unit of heating surface as they do now is made by no less an authority than the boiler division of the United States Geological Survey. The statement comes as the result of a series of experiments conducted at its fuel-testing plant at St. Louis. It is proposed to gain this increase in capacity by sub-dividing the heating surface and water streams more finely and by allowing less restriction of the water inside the boilers and by using high forced and induced draft to put a large mass of gases through the boiler at a very high speed.

For some weeks past a series of experiments has been made on small multi-tubular boilers, to test Perry's theory that, generally speaking, every boiler will absorb by convection from the gases passing through it the same percentage of heat which could possibly be absorbed by any boiler containing water at a given steam temperature. This efficiency, therefore, is independent of the temperature of the entering gases and of the amount of gases flowing through the boiler.

In the government tests, the boilers were fed with air heated electrically. The deduction referred to was accurately verified, it being found that, when keeping the initial temperature of the gases constant, the final temperature of the air remained the same, whatever the amount of air sent through the boiler per second.

The surprising result of the test is the verification of the feature of Perry's theory relating to the velocity of the gases parallel to the heating surface. Mr. Perry considers that a high velocity of gases parallel to the heating surface scrubs off more or less of the dense film of gases adhering to the metal surface, which film of gases has already become cold by proximity to the metal. The higher the velocity of gases the more the scrubbing effect, and consequently the greater the amount of heat transmitted.

Mr. Perry's theory and the government's verification of it would seem to place the steam boiler on a fairly secure mathematical basis, such as that worked out for generators and motors.

A New Departure in Cooling and Humidifying Textile Mills*

By W. H. Carrier, M. E.

The subject of cotton conditioning is one of vital interest to the operators. The effect of climatic conditions upon the various processes in textile industry, particularly in the spinning and weaving of cotton, has long been known and is well understood by all mill operators. Every cotton mill superintendent is familiar with the fact that the cool, moist days of the spring and fall enable him to produce a stronger yarn and an increased output. He also knows that the hot, dry weather of summer and the cold, dry weather in winter without artificial means of mill conditioning reduces the output both in quantity and quality. Owing to this variability, it is impracticable to speed many of the machines, particularly the spinning frames, to the maximum under which they could be driven under ideal conditions. For these reasons the natural, cool, moist climate of England, with its great uniformity of conditions, is unrivaled for textile industries. On the other hand, the natural, dry, hot climate in the South is very unfavorable and practically prohibits the spinning of fine yarns unless some artificial means is employed to counteract the natural conditions.

It is the purpose of this paper to show both the scientific principles applying to the artificial conditioning of cotton mills, and to describe a system of conditioning which the writer believes embodies such principles most effectually.

IDEAL CONDITIONS

The temperatures and humidities suitable for various departments of a cotton mill vary with the nature of the process and the fineness of the yarn. In general, the finer the yarn the higher the humidity desirable. The following schedule of temperatures and humidities may be considered good practice:

	Humidity	Temperature
Card Room	60 to 65%	70 to 75°
Spinning Room	60 to 75%	75 to 80°
Winding Room	75 to 80%	70°
Weave Room	75 to 80%	70 to 75°

In the card room one of the principal objects to be attained is the prevention of electrical conditions. An excessive humidity here, however, is quite as objectionable as insufficient moisture. It has been the writer's experience that higher humidity than 65 per cent. causes trouble and that the most satisfactory condition is about 60 per cent. in this room. In the spinning room the humidity suitable is largely dependent on the number of the yarn, the finer yarn requiring higher humidity. In the winding room it is desirable to have as high a percentage as possible.

CONDITIONS AFFECTING HUMIDITY

Many of the failures and partial successes in artificial conditioning of cotton mills has been due to a disregard of the peculiar circumstances affecting the humidity of the mill. One set of conditions is met with during the cold weather, while an entirely different set is encountered in hot, dry weather. An apparatus to be entirely successful must meet both these cases equally.

A very common error in the design of a humidifying system or apparatus is to assume that a cotton mill with all its machinery may be taken care of in the same way and with equal ease as a vacant room, whereas no greater mistake could be made. An apparatus that will work to perfection in a vacant room, or even in a winding or weave room, may be an utter failure under the trying conditions in the spinning room. A system may work admirably in the spinning room in winter, yet be entirely inadequate to meet the exigencies of hot summer weather.

The most important point to be considered under summer conditions is the great amount of heat generated by the textile machinery; for it may be observed that of the great amount of power employed in driving the machinery, practically all is ultimately converted into its equivalent of heat within the building. As an illustration of this, a temperature has been observed in a spinning room 33° above the outside air with windows, doors and ventilators closed, and where there was no other source of heat than the power absorbed in the machinery. The effect of this temperature rise is disastrous to the natural humidity in the room, for the higher the temperature the greater is the moisture deficiency, and therefore the lower the percentage of humidity.

This relation between temperature and humidity is very close. The greater the rise of temperature, the more moisture must be added, hence the greater difficulty in humidifying the room. If most air at the point of saturation is blown into the room and there heated 9°, the resultant humidity will be 75 per cent. If it is heated 11¼°, the humidity is 70 per cent.; if heated 13½°, the humidity is 65 per cent., and so on.

The following test made in the spinning room of one of the Southern cotton mills shows the effect of temperature rise upon the humidity where no hu-

*Read before the Annual Convention of the American Association of Cotton Manufacturers at Philadelphia, May, 1907.

midifier is used. In the room where these readings were taken there was no other source of heat than that generated by the machinery.

OUTSIDE CONDITIONS

Dry bulb temperature, 48°.
Wet bulb temperature, 47°.
Per cent. humidity, 90 per cent.
Grains of moisture per cubic foot, 3.8.

SPINNING ROOM

Dry bulb temperature, 81°.
Wet bulb temperature, 66°.
Per cent. humidity, 44 per cent.
Grains of moisture per cubic foot, 5.00.

It may be observed that the outside conditions were those usually considered most favorable. The outside air was practically at the point of saturation, the weather was very foggy with a fine, drizzling rain. A few windows in the room were partly open, yet the humidity in the mill was exceedingly low.

The following table shows the humidities that will be obtained in a mill under various conditions of temperature rise and outside humidities:

HUMIDITIES OBTAINED IN MILL UNDER VARIOUS CLIMATIC CONDITIONS WITHOUT ARTIFICIAL HUMIDIFICATION

OUTSIDE CONDITIONS		INSIDE CONDITIONS	
Temp.	% Humid.	Temp...	% Humid.
30	100	80	19
30	50	80	9½
40	100	80	26
40	50	80	13½
50	100	80	36
50	50	80	19
60	100	80	53
60	50	80	26
70	100	80	73
70	50	80	36½

METHOD OF DISPOSAL OF HEAT

The heat that is generated by the machinery in the mill must be disposed of either by natural or artificial means, of which there are but three ways:

(a) Radiation—natural.
(b) Ventilation—natural or artificial.
(c) Evaporation—artificial.

The amount of heat disposed of through radiation depends on the temperature difference inside and outside of the mill. The greater portion of the heat is thus disposed of during winter weather, while in warm summer weather it must be taken care of through ventilation. There is always some natural ventilation or infiltration, as it is called, in the mill, even with all windows and doors closed. The amount of this infiltration is equal to about one change of air per hour in the building during cold winter weather, and disposes of about one-half as much heat as radiation. It is owing to this natural infiltration going on in the building that it is impossible to humidify a building and keep it humidified without a continued addition of moisture. With the system here proposed an air pressure is maintained in the building sufficient to make all leakage outward. By this means a very uniform condition is maintained.

In order to cool the mill in summer natural ventilation is increased by opening doors, windows and roof ventilators, but at the same time the effectiveness of this means of ventilation is greatly lessened in summer by the smaller difference between inside and outside temperatures. Natural ventilation is never satisfactory in spinning fine yarns, but artificial ventilation can be so applied as to overcome all the objections to natural ventilation and maintain a constant volume of air supply, regardless of weather conditions. To be most effective humidifying and ventilating must go hand in hand.

Cooling by evaporation of a water spray is an effective means of absorbing the heat generated in a room, since it accomplishes both cooling and humidifying simultaneously. In cooling by evaporation approximately 1,050 heat units are absorbed for every pound of moisture evaporated. One pound of moisture evaporated per minute would therefore dispose of heat generated by 25 horsepower of machinery. So far as the cooling effect is concerned, it matters not whether evaporation cools the air before or after it is introduced into the room.

EVAPORATION AND VENTILATION

Evaporation and ventilation are independent—ventilation is necessary to secure evaporation. The maximum amount of moisture a cubic foot of air will hold depends upon the temperature. Whenever air contains the maximum possible amount of moisture at a given temperature it is said to be saturated, or at the dew point. Air at 60° cannot hold more than 5.8 grains per cubic foot; at 65°, 6.8 grains; at 70°, 8 grains, etc. Therefore, evaporation can occur only when the air in the room or at the apparatus is below the point of saturation. Hence, it follows that in order to secure cooling effect by evaporation the necessary amount of air must be introduced into the room to evaporate and to absorb the moisture. While theoretically only sufficient should be admitted to obtain a condition of saturation in absorbing the moisture, yet practically a great deal more than this must be introduced, because the air in the room must be kept considerably below the point of saturation. The amount of air which must be admitted into the room to keep within a certain per cent. of saturation will vary with the degree of saturation required, and with the amount of moisture contained in the outside air. In winter, when the air is cold and dry, a very much smaller amount is required than in summer, when the air is moist.

The disadvantage of depending on natural ventilation is that it is at all times

variable and uncertain. It is most difficult to obtain when it is most needed, and is usually so inefficient that even with the cooling effect of evaporation a considerable proportion of the heat must be cared for by radiation, producing an undesirable rise in temperature in the mill. Natural ventilation combined with evaporation works most satisfactorily in winter, as a small volume of very dry air is much more easily humidified than the large volume of ventilation required in summer time, together with the large amount of evaporation for cooling.

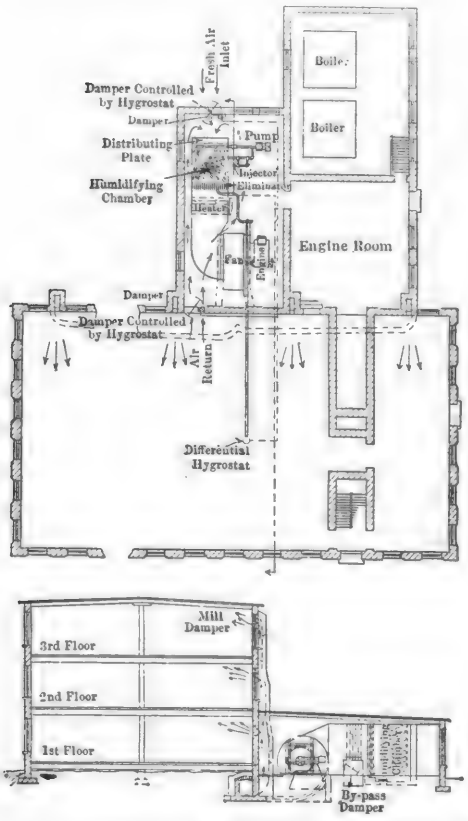


FIG. 1—FIRST FLOOR PLAN AND ELEVATION OF SMALL MILL

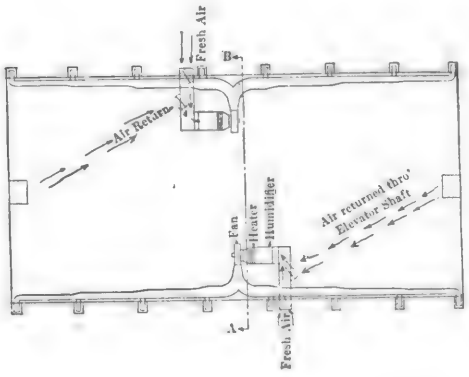
In using natural ventilation, the cool, dry air settles along the floor and next to the walls; the warm, moist air, being lighter, goes out through the ventilators without fully relieving the condition of the room. To cool properly the spinning room in summer, where ring spindles are used, and at the same time to maintain 70 per cent. humidity, requires the air in the room to be changed once every five or six minutes, depending upon the horsepower developed per cubic foot of space. This is required if the heat is to be properly removed, whether using natural or artificial ventilation, and whether humidifying the air before or after it enters the room.

The difficulties in the way of uniformly humidifying this great quantity of air after its admission into the room are very apparent. In fact, with fine yarn, it is impossible to obtain a sufficient amount of natural ventilation to cool the spinning room in hot weather, owing to the disastrous effect of fluctuating window drafts upon fine "numbers."

THE IMPROVED SYSTEM

This improved system, which it is the purpose of the writer of this paper to describe, is a fan system. It is adapted equally to summer and winter conditions using the same apparatus. It humidifies and cools in summer by artificial ventilation with cold saturated air, and humidifies and heats in winter by first saturating the air at the proper temperature, and then heating the air after saturation to a temperature sufficient to maintain the required temperature and humidity conditions in the room.

The apparatus consists of a humidifier, fan and heater and a system of ducts for the distribution of the humidified air. The humidifier consists of a large air chamber in which spray is atomized under high pressure by means of a large number of cyclone nozzles. The air is thus filled with an extremely fine mist in large volume, and thereby brought to the point of saturation. The free moisture is then separated from the air by an eliminator. The two principal features which make this humidifier a success are the



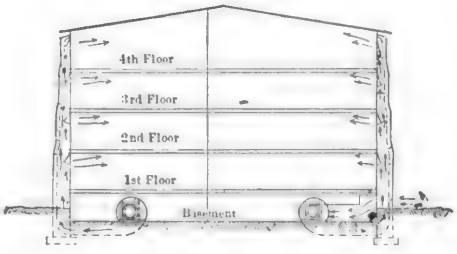


FIG. 2—BASEMENT PLAN AND ELEVATION OF LARGE MILL

design of the spray nozzles and the design of the eliminator. The construction of the nozzle is such that it is practically impossible to clog it with foreign material, the smallest hole being 3-32 of an inch in diameter, yet it throws a perfectly atomized mist by reason of the centrifugal principle upon which it operates. The very difficult function of separating this finely atomized spray from the air current at high velocity is performed by an eliminator of special design. The form of this eliminator was determined by lengthy experimental investigations, and has now been in successful use for the past four years. It is practically the same as that used in the Buffalo air washer for ventilating public buildings. The fan and heater are of the usual design and need no special mention; the only variation from the standard being that the air is by-passed around the heater during the summer, thereby avoiding the frictional resistance of the heater.

AIR-DISTRIBUTING SYSTEM

There are several methods by which the air may be satisfactorily distributed through the room. The method adopted will depend entirely on individual conditions, such as the architectural design, size of the mill, number of floors, arrangement of departments, and whether the mill is old or new. In the smaller new mills the arrangement shown in Fig. 1 is desirable. In this arrangement the air ducts are placed in pilasters on one side of the building which connect with the main air duct running underneath the floor. In several large story mills it is usually desirable to place the apparatus in the basement as shown in Fig. 2, using two sets of apparatus and two main ducts with hollow pilasters on either side of the building. This arrangement permits a more simplified control of the conditions in the various departments. In the old mills, and frequently in new mills, the arrangement shown in Fig. 3 is usually desirable. In this arrangement two or more main risers are used and the air is distributed by means of diffusers and by location of vent ducts as shown. This arrangement gives perfect distribution at small cost for installation, and has the advantage of a low frictional resistance. In the usual mill construction the air is sufficiently vented through the natural leakage in the building, and through the elevator shafts either to the first floor or to the basement, depending on the design of the building; otherwise registers are easily located. Provision should always be made to allow this vented air to escape outdoors or to return it to the apparatus as conditions may demand.

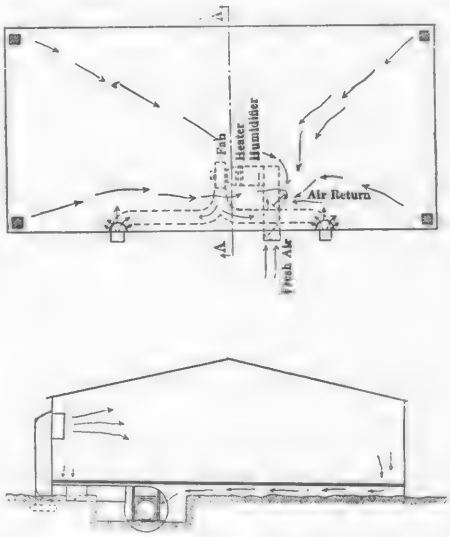


FIG. 3—FIRST FLOOR PLAN AND ELEVATION OF OLD MILL BUILDING

An important feature of this system is the regulation of the proportion of air returned to outside air. In summer where maximum cooling is required it is necessary to use a maximum amount of air taken from outside, while in winter a much smaller air volume is required and about two-thirds may be returned to the building. The proportion of air re-

COOLING EFFECT BY EVAPORATION IN HUMIDIFIER

Outdoor Air			Air Leaves Humidifier			Degree	Grs. Moisture
Temp.	% Hdty.	Grs. Mo. per cu. foot	Temp.	% Hdty.	Grs. Mo. per cu. foot	Cooling Effect	Added per cu. ft.
85	60	7.7	75	95	9.0	10	1.3
	50	6.35	72	95	8.15	13	1.8
	40	5.05	69	95	7.4	16	2.35
80	60	6.6	71	95	7.9	9	1.3
	50	5.45	68	95	7.15	12	1.7
	40	4.35	64½	95	6.4	15½	2.05
75	60	5.6	66	95	6.75	9	1.15
	50	4.65	64	95	6.25	11	1.6
	40	3.7	61	95	5.65	14	1.95
70	60	4.8	62	95	5.9	8	1.1
	50	3.95	59½	95	5.4	10½	1.45
	40	3.15	56½	95	4.9	13½	1.75

turn to outside air determines in summer time the temperature of saturation, and, therefore, the fixed amount of moisture in the air.

METHOD OF OPERATION IN SUMMER

During the warmer weather the humidification of the air is obtained without the use of any source of heat, thereby securing the maximum cooling effect of evaporation and ventilation combined. In humidification the cooling depends upon the amount of moisture which the air will absorb to saturation, while the per cent. humidity after saturation depends entirely upon the temperature.

On the page preceding is a table of the cooling effects and resultant humidities in the room under various climatic conditions.

Following is given a table which shows the average cooling effects that may be obtained in various localities. It should be noted here that the cooling effect by evaporation is exactly equal to the wet bulb depression, *i. e.*, the temperature of the air will drop when saturated to the wet bulb temperature. It will be noted that the air may be cooled from 10° to 13° on the average.

AVERAGE MONTHLY MAXIMUM WET BULB DEPRESSION WITH CORRESPONDING PER CENT. HUMIDITY

Locality	July		August		September	
	W. B. Dep.	% Hdt.	W. B. Dep.	% Hdt.	W. B. Dep.	% Hdt.
Columbia, S. C.	15	50	14½	51	14	50
Charlotte, N. C.	15½	48	12	57	14	49½
Philadelphia, Pa.	13	43½	13	44	12	52
Syracuse, N. Y.	12	55	11½	54	9½	59

It should be noted that the humidifying is directly dependent upon the cooling effect. If the temperature is allowed to rise a great excess of moisture is required for humidifying, and the process is thereby made more difficult. On the other hand, if the ventilation is ample to prevent a rise of temperature in the mill, very little moisture need be added to the air and the proper humidity is easily attained. This is the basic principle upon which this system is designed to meet summer conditions. The humidity is automatically controlled by controlling the temperature of the humidified air, upon which it is dependent, as has been shown.

ADVANTAGES OF SYSTEM IN SUMMER

The results obtained by this method of cooling and humidifying are exactly what would be obtained in cool, foggy weather, by blowing the outside air into the mill in sufficient quantity to keep the temperature within a certain degree of the outside air temperature. The amount of air which would have to be used to accomplish this would depend entirely upon the amount of heat liberated by the machinery, which is easily determined. This cold, moist air ventilation, the writer believes, is the only method for effectually conditioning the spinning room in the hot, dry weather of summer. It provides for a cooling effect which can be obtained in no other way, and by creating an air pressure within the building it excludes the warm, dry air which tends to lower the humidity. The mill is cooled without opening the windows; in fact, is made very much cooler than it possibly could be made by opening all windows and ventilators. This permits the successful spinning of fine yarns in Southern climates, where it would otherwise be impossible, as the air is so introduced that it does not blow lint around the room, nor produce drafts near the floor. The diffuser distributes the air perfectly at low velocities. Humidity and temperature conditions are everywhere uniform.

OPERATION IN WINTER

The operation in winter is practically the same as in summer except that a considerable proportion of the air is returned from the building to the apparatus, and the heat is disposed of largely through radiation. The fan is also operated at lower speed, as a large volume is not then necessary for cooling. The air is heated after being humidified in the usual manner and the temperature may be regulated independently in each department without affecting the humidity. This result is attained through the use of auxiliary indirect heaters in the rooms requiring lower humidity and greater amount of heating. No auxiliary heaters are required in the spinning room, for this is the department in which the most heat is developed. In the larger mills, where air ducts are placed on each side of the building, a double duct system of heating is employed, which takes the place of the auxiliary heaters and at the same time permits the temperature to be regulated in each department independently of the air volume and humidity. The temperature of the humidified air is regulated by means of heated spray water instead of using a variable air return as in the summer time. The spray water is heated by a steam injector, which is controlled automatically to obtain the desired temperature of humidification.

(*To be concluded next month*)

NEW DEVICES

Wing's Turbine Fan

Wing's turbine fan is the combination of two well-known machines, the Wing disc fan, and a well-designed turbine engine. The combination is the invention of L. J. Wing, president of the L. J. Wing Mfg. Co., who originally invented and patented the disc fan, of which many thousands are in use both in this and other countries. Since the L. J. Wing Mfg. Co. placed the new fans on the market they have met with much success, the manufacturers finding an unlimited demand for such a combination.

The blades of the fan are practically

THE NEW WING TURBINE FAN

the same as those used on the well-known Wing disc fan when used for ventilation, run by belt, electric motor, or direct connected old type engine.

The turbine engine consists of a series of turbines, buckets or vanes fastened to a band or ring, which, in turn, is fastened to the end or periphery of the fan blades as shown in the illustration. Two or more nozzles of special design impinge the steam into the buckets, and cause the fan to rotate. This gives an economical and positive power.

The small amount of steam from the nozzles after exerting all its energy in driving the fan passes along with the air so that no exhaust pipe is required. This fan can be used in places where no other type of fan and engine could be used to advantage. At the present time they are used largely for mechanical draft for boilers. When used for this purpose the fans are masoned into the side or rear wall of the boiler just below the grates.

The mechanical draft enables the burning of a cheap grade of fuel which cannot be burned with natural draft. Aside from that there are many other advantages which could be mentioned, such as saving in cost of fuel, adding to capacity of boilers by heating the tubes more evenly and full length, thus keeping the boilers in better condition, and the fact that the steam from the fan helps to deteriorate the clinkers, keeping the grates in better condition.

Another advantage is the flexibility of this system of mechanical draft. The fans can be moved or more fans can be added as the plant grows, and they are not affected by atmospheric conditions, as on a dull day with a heavy fire, and possibly bad coal.

The turbine fan is remarkable for its simplicity and the strength of its construction, and having no wearing parts, except the ball bearings, they require no care or attention beyond putting vaseline or other lubricant in the bearings once a month.

A Covering for Range Boilers

To keep hot water always on tap in the kitchen boiler without too much trouble and expense is the great desire in the household. This is now made possible by means of the "Keystone" range boiler cover, a new insulating covering for hot water boilers, which has just been placed on the market.

The "Keystone" cover is a heat-retaining wrapper which fits snugly around the boiler, and is held in place by wire lacing. It is made in various sizes, to fit different sizes of boilers, and consists of several layers of insulating materials, which are enclosed in an outer sheet of heavy canvas.

This device is manufactured by the H. W. Johns-Manville Co., New York, and is the subject of an interesting folder which the company has recently issued, and which, we understand, may be had free on request to any of its numerous branch offices.

A Dustless Sweeping Compound

Announcement has just been made of recently completed arrangements by which the H. W. Johns-Manville Co., New York, has acquired the exclusive sales agency for "Perolin" in the United States.

"Perolin" is a fireproof floor-cleaning compound. Instead of laying the dust it absorbs it. It draws the dust from cracks and crevices in the floors and from carpets and rugs. It is also a powerful disinfectant, destroying all disease

germs that are common with dust, an important feature when it is considered that sixty-five per cent. of all diseases are caused by dust infection.

A New Line of Boilers

The McCrum-Howell Company, New York, has just placed on the market its new line of improved "Richmond" sectional boilers and "Richmond" round boilers for steam and hot water. These boilers have been made from designs and models furnished by the patentee, William M. Mackay, past president and now secretary of the American Society of Heating and Ventilating Engineers. The McCrum-Howell Company has secured the exclusive services of Mr. Mackay in an advisory capacity, in connection with the designing and building of house-heating boilers and radiators, and henceforth he will devote his time and energies along this line.

The new models are the result of almost forty years of development and evolution in the manufacture of house-heating boilers, and, as Mr. Mackay, during that period, has designed, patented and marketed many of the leading constructions of the boilers now on the market, it may be expected that the new line will combine the best and most salient points of his wide experience and extensive knowledge of boiler construction.

For a long time past experiments and tests have been conducted at the company's plant in Norwich, Conn., with the most gratifying results. It is claimed that provision has been made in the new boiler for a larger grate and fire surface, and also a larger space for a fuller combustion of the gases. The experiments already referred to have proven that when excessive heating surface is cut out the large clear space that it leaves above the fuel, more than compensates for the excessive surface which has been removed, and it has been found that with a good clear space in which the flames can play and the gases be ignited, the boiler will do better work than it did before.

The new "Richmond" sectional boiler is of the water-leg base, screw-nipple type. It contains some interior modifications which make it specially adapted to burning either hard or soft coal, coke or wood.

The large area of direct water-heating surface, which is provided in both types of boilers, and which is exposed at all times to the consuming gases, gives excellent results, as the flames of the heated gases come in close touch with and envelop the over-hanging fire surface. The combustion products are thrown up into and through the flues and pass to the outlet at the rear of the boiler at a low temperature.

A catalogue and literature descriptive of the new boiler is being placed in the hands of the trade.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

Plans for the Summer Meeting in Milwaukee, July 18 and 19

Preparations are going rapidly forward for the semi-annual meeting of this society in Milwaukee, July 18 and 19 next. Special rates have been secured at the Hotel Pfister, which will be the headquarters.

It is planned to have the members and guests meet in Chicago on Wednesday, July 17, and take the night boat on the Goodrich line for Milwaukee. This boat will leave its dock at the foot of Michigan avenue at 9 P. M. Tickets are $1.00 each way. Single berths may be had for $1.00 and double berths for $2.00.

May Meeting of Illinois Chapter

The regular monthly meeting of the Illinois Chapter was held May 6 in the rooms of the Western Society of Engineers, Chicago, the attendance being the largest that the chapter has known.

At this meeting the president appointed a committee to nominate candidates for office in the Chapter, these to be submitted in time for the election, which will take place at the annual meeting of the Illinois Chapter in October next.

The Committee on Compulsory Legislation made a report to the effect that they had presented a bill to the present Legislature relating to the ventilation of public buildings, and it is greatly to be hoped that the bill will be passed, inasmuch as there is great need of stringent laws relating to this subject.

The principal feature of the meeting was an impromptu talk by Mr. August Kehm, a member of the society and also one of the charter members of the chapter, relating to an extensive power and heating plant designed by him and installed under his direction in one of the Canadian cities. This talk was illustrated with the original drawings from which the work was installed, and resulted in much discussion as to the best method of designing and constructing plants of this type.

We regret that it is impossible for us to give our readers the benefit of this discussion, but are unable to do so on account of the fact that all such papers and discussions read in the chapter must first be submitted to the board of governors of the parent body before being given to the public.

The interest taken in this meeting showed signs of much good to be derived from membership in the chapter, and we are of the opinion that the fall and winter meetings of 1907 and 1908 will result in many additions to the membership.

NATIONAL ASSOCIATION OF MASTER STEAM AND HOT WATER FITTERS

The Entertainment at the Recent Washington Convention, May 20-23

A novel arrangement of entertainment plans, adopted at the Master Steam Fitters' convention, worked out so successfully that it is more than likely to become an established custom at future meetings. This was the organization of the supply men present of an entertainment committee, made up of their number, all of whom contributed equally to a fund which went to pay the entertainment expenses incurred by the supply men during the convention. All the representatives of the trade press present were made members of the committee and exempted from the payment of dues.

The committee was made up of representatives of the following firms, with W. G. LeCompte as chairman and Frank K. Chew as secretary:

Norwall Mfg. Co.
Abendroth Bros.
H. B. Smith Co.
Richardson & Boynton Co.
Niagara Radiator Co.
Wm. H. Page Boiler Co.
New York Heater & Supply Co.
A. A. Griffing Iron Co.
Ashton Valve Co.
J. L. Mott Iron Works.
United States Radiator Co.
Herendeen Mfg. Co.
Stoever Fdy. & Mfg. Co.
Jenkins Bros.
McCrum-Howell Co.
Gurney Heater Mfg. Co.
Bridgman Bros.
Keasbey & Mattison Co.
American Radiator Co.
Union Radiator Co.
J. A. Donnelly.
Isaac A. Sheppard & Co.
Pierce, Butler & Pierce Mfg. Co.
Vapor Heating Co.
Model Heating Co.
Fowler & Wolfe Mfg. Co.
Standard Steam Specialty Co.
H. W. Johns-Manville Co.
National Radiator Co.

THE GOLF MATCH

Previous to the formation of the entertainment committee, the social program had been inaugurated with a special golf match for members of the Eastern Trade Golf Association and members of the Master Steam Fitters' Association. This match was played Monday, May 20, at the links of the Columbia Golf Club, Washington, which had been secured for the use of the players through the courtesy of M. E. Danforth, one of the Washington members of the Trade Association. Those who took part in the match were E. H. Roberts, C. N. Brizse, M. E. Danforth, A. S. Armagnac, Geo. M. Bridgman, Frank K. Chew, and G. G. McDuff. Each player was handicapped in accordance with his best previous score, and a total of 36 holes were played. The winners were: First prize, pearl-handled carving set, won by G. G. McDuff, 157-72, 85; 147-72, 75. Total, 160. Second prize, metal ink stand, won by M. E. Danforth, 89-9, 80; 91-9, 82. Total, 162. Third prize, copper ash tray, won by C. N. Brizse, 104-20, 84; 112-20, 92. Total, 176.

THE BOWLING MATCHES

Other events arranged by the Eastern Trade Golf Association, through its committee, W. G. LeCompte and M. E. Danforth, were two bowling matches, one for the men Tuesday evening, May 21, and the other for ladies, Wednesday evening, May 22. Those who took part in the men's bowling match were: Steam Fitters, H. S. Hadden, Geo. H. Zellers, M. G. Leigh, E. Monroe, W. J. Baldwin, Jr., and C. N. Brizse. The E. T. G. A. team was composed of W. R. Watters, Frank K. Chew, A. S. Armagnac, W. C. McCormick and E. H. Roberts. The match resulted in a victory for the master steam fitters in two straight games, the steam fitters thus turning the tables on the E. T. G. A. for the latter's victory of last year at Atlantic City. The winners were each presented with a set of clothes hangers.

The ladies' bowling match the following evening was participated in by over twenty of the visiting ladies, the winners, scores and prizes being:

Miss B. Zellers, 180, handbag; Mrs. C. N. Brizse, 168, traveling bag; Mrs. Wm. J. Baldwin, Jr., 165, card case; Miss N. Zellers, 142, silver buckle; Mrs. E. H. Roberts, 137, center piece; Miss Herbert, 35, a Teddy bear. Other prizes were awarded as follows: Mrs. A. S. Armagnac, 107; Mrs. J. Shreves, 105; Mrs. J. C. Faulkner, 102; Mrs. Thomas Eagan, 98; Miss Eagan, 96; Mrs. L. Moore, 95; Miss Long, 88; Mrs. E. J. Febrey, 88; Miss Ellison, 84; Mrs. O'Keefe, 83; Mrs. Sadler, 80; Miss Rutzler, 78; Mrs. W. H. Gaylord, 68; Mrs. Frank J. Corbett, 65.

The prizes for the golf match and the bowling matches were awarded at a collation Wednesday evening immediately following the ladies' bowling tournament. Fully sixty guests were present at the dinner and the affair proved a delightful climax to the entertainment of the convention.

Among the other plans for the enjoyment of the ladies, carried out by the entertainment committee, in addition to those connected with the bowling tournaments, was a boat trip Monday, May 20, down the Potomac to Mt. Vernon; an automobile ride through the capital Tues-

day morning, May 21, and a drive Wednesday morning, May 22, along Rock Creek, one of Washington's beauty spots. On Monday evening Mr. LeConipte was the host on a carriage trip to the Congressional Library.

THE LADIES PRESENT

Among the ladies present at the convention were:

Mrs. C. N. Brizse, Mrs. E. H. Roberts, Mrs. H. B. Gombers, Miss Blackwood, Mrs. John T. Sadler, Miss A. Sadler, Miss H. Sadler, Miss Smith, Miss Rutzler, Mrs. W. J. Baldwin, Jr., Mrs. J. A. Almirall, Mrs. F. J. Corbett, Mrs. T. B. Cryer, Mrs. Eitapenc, Mrs. W. H. Gaylord, Mrs. A. S. Armagnac, Mrs. J. C. Faulkner, Miss Maguire, Mrs. L. Moore, Mrs. Sellers, the Misses Zellers, Mrs. E. R. Soleau, Mrs. F. B. Howe, Mrs. T. B. Eagan, Miss Eagan, Mrs. O'Keefe, Miss Hurd, Mrs. J. F. Buerkel, Miss Buerkel, Miss M. J. Birge, Mrs. Bashore, Mrs. Merz, Mrs. Butterfield, Mrs. J. Geoghegan, Mrs. H. H. Highlands, Mrs. Smith, Mrs. Foster, and Mrs. J. J. Blackmore.

New York State Association, Master Steam and Hot Water Fitters

At the meeting of the New York State Association, held May 2, at the headquarters of the National Association, in New York, the following officers were elected for the ensuing year:

President, Wm. C. Vrooman, Schenectady; vice-president, Charles N. Brizse, New York; secretary-treasurer, Joseph G. Geoghegan, New York; directors, Charles N. Brizse, New York; Frank Dobson, New York; Frank H. Falls, Rochester; Willis H. Gaylord, Binghamton; Joseph G. Geoghegan, New York; Edward F. Joy, Syracuse; John T. Sadler, Elmira; Wm. C. Vrooman, Schenectady; sergeant-at-Arms, Wm. Milligan, Rochester.

The board elected Henry B. Gombers recording secretary. After the convention the New York City Association tendered a dinner to the visiting delegates at the Wool Club. Following an address of welcome by Charles N. Brizse, a vaudeville program was offered.

New Jersey State Association, Master Steam and Hot Water Fitters

The following officers have been elected for the ensuing year by the New Jersey State Association: President, Sol. Berla, Newark; vice-president, J. S. Boyse, Ocean Grove; secretary-treasurer, Harry Geiser, Newark; Directors, T. B. Cryer, Newark; E. B. Denny, Newark; A. E. Van Cleve, Ocean Grove; George S. Aldous, Passaic, and E. R. Soleau, Newark.

Philadelphia Local Association, Master Steam and Hot Water Fitters

At the annual meeting of the Master Steam and Hot Water Fitters' Association of Philadelphia, the following officers were elected:

President, P. Gormly; vice-president, John C. F. Trachsel; treasurer, S. A. Jellett; secretary, M. G. Sellers; directors, William P. Thompson, Roberts Leimau and J. J. Gerhard.

New Books

"Quick Rules for Heating and Ventilating," by William J. Baldwin, Jr., is a compilation of a number of terse, short rules that the author has found useful in his own experience. In offering his rules the author acknowledges his indebtedness to his father, William J. Baldwin, from whose works, he states, he has learned much of what he puts into a few brief approximate rules. Pp. 25. Size 4½x6 inches. Price $1.00. William J. Baldwin, Jr., 1181 Broadway, New York.

Trade Literature

Green's Fans, Blowers and Exhausters is a catalogue of the types and sizes carried in stock by the Green Fuel Economizer Co., Matteawan, N. Y., with descriptions of a number of fans specially designed for various purposes. The publication also contains an account of recent improvements in fan constructions, and concludes with much interesting engineering information and tables. The reading matter is voluminously illustrated with photographs and sketches, showing many typical installations, and the work is one that will prove useful to all engaged in designing fan systems. We understand a copy of the catalogue may be had on request. Pp. 96. Size, 6x9 inches (standard).

Bundy Steam Traps is the subject of an elaborately illustrated descriptive treatise published by the A. A. Griffing Iron Co., Jersey City, N. J., covering the uses of the Bundy steam trap in automically feeding boilers, returning condensation to boilers, relieving steam mains, heating coils, etc., and in increasing the efficiency of steam using apparatus. Much interesting information on the action of these traps, based on the experience of those who have used them, will be found of special value. There are also list of sizes, capacities, parts, etc., of the Bundy traps, all sizes, together with fourteen pages of photographic views, showing typical installations. Pp. 68. Size, 6x9 inches. (Standard.)

Sylphon Regitherm, an automatic temperature regulator, is illustrated and described in a folder issued by the makers, The Fulton Co., Knoxville, Tenn. The regitherm is designed to be placed on the wall of a room, from which it operates dampers in the furnace or boiler. The regitherm or motor consists of a metal bellows within which is hermetically sealed a small amount of volatile liquid whose vapor, as effected by the temperature, changes its pressure.

TRADE AND MISCELLANEOUS NOTES

Among the Supply Trade at the Recent Convention of the National Association of Master Steam and Hot Water Fitters

A. A. Griffing Iron Co., Jersey City, N. J., was in evidence as usual, in the persons of W. S. Cosgrove, of the home office, and A. S. Mappett, of the Philadelphia branch, and the Bundy line was well looked after.

J. L. Mott Iron Works, New York, had its interests taken care of by J. J. Blackmore, of the home office, and J. Lucas, of the Philadelphia office, both of whom greeted many old friends among users of Sunray heaters.

William M. Mackay, of the Mackay Mfg. Co., New York, was the center of many interested groups who wanted to obtain further information regarding the new line of Manhattan boilers and Manhattan and Knickerbocker radiators which the company has just placed on the market. All inquirers were presented with price lists of the round, sectional and vertical sectional types. Mr. Mackay came in for many enthusiastic compliments on the design of his boiler and great things were predicted for its success.

John Simmons Co., New York, was represented by T. V. Foster, who was a prominent figure in the supply house party.

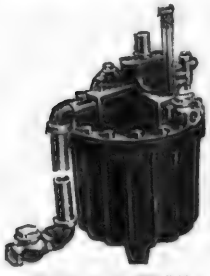
Pierce, Butler & Pierce Mfg. Co., Syracuse, N. Y., had worthy representatives present in Secretary P. M. Beecher, of the home office, and G. H. Giles, of the Philadelphia branch. Many inquiries were heard for E. C. Molby, manager of the company's eastern branches, who was unavoidably detained in New York.

30,000 HOMES
600 CHURCHES AND SCHOOLS
are being satisfactorily and economically heated by the
KELSEY
Warm Air Generator
SYSTEM

If you do not know all about the Kelsey, why not?
Send for Booklet and for 112 Page Book, "OPINIONS"

The Kelsey is unlike any furnace; warms fresh air by a better method; warms large volumes of air properly and forces into every room.

KELSEY HEATING COMPANY
307 Fayette St., Syracuse, N. Y. New York Office, 156 Fifth Ave.



CLASS A RETURN TRAP

THE ALBANY RETURN STEAM TRAPS

Have been the standard for over thirty-two years. For returning water under pressure to the boiler they will perform this duty fully as well and in many cases better than the so-called steam loop.

SEND FOR CIRCULARS A. B. C. AND D.

CLASS D TRAP HIGH PRESSURE

MANUFACTURED BY

ALBANY STEAM TRAP CO., ALBANY, N. Y.

ESTABLISHED 1870

JAMES H. BLESSING, Pres. **THOMAS F. RYAN, Treas**

American Radiator Co., Chicago, Ill., and American radiators and Ideal boilers were kept in prominence through a large array of representatives, including Charles K. Foster, George E. Downe, C. A. Gott, manager of the New York office; F. L. Huddleston, of the Philadelphia branch; F. B. Howell and E. S. Stoughton.

H. B. Smith Co., Westfield, Mass., had as its representatives J. C. Faulkner, manager of the New York office; C. A. Miller and W. H. Batemen, W. G. Culbert and W. C. Jackson, who were kept busy greeting friends of the Mercer, Mills and Cottage boilers and Union radiators.

Fowler & Wolfe Mfg. Co., Philadelphia, Pa., set the pace for the manufacturers of wall radiation through the company's president, Wiltsie F. Wolfe.

Gurney Heater Mfg. Co., Boston, Mass., was prominently on deck, as usual, and the interests of the Gurney series of boilers and radiators was ably taken care of by F. D. Miller, of the Washington office.

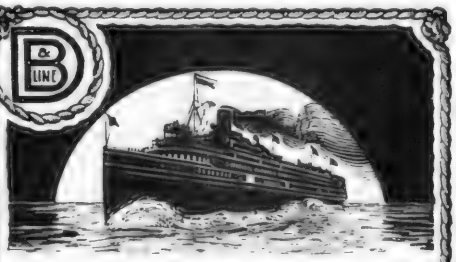
Standard Steam Specialty Co., New York, through E. H. Roberts, added much to the reputation enjoyed by the Utility line of heating specialties as well as the firm's reputation for hospitality.

H. W. Johns-Manville Co., New York, had an effective delegation present in Messrs. Tower, Burdick, Grant and Austin, of the home office.

Robert A. Keasbey Co., New York, was capably represented by Harding Benedict, who obtained an added degree of popularity through the souvenirs he handed out of attractive leather match boxes.

New York Heater & Supply Co., New York, was represented by W. S. Newkirk and T. M. Ward, who took care of the interests of the Henderson boilers, Holland radiators and the Moline vacuum vapor system of heating. A new and interesting circular describing the latter was the subject of much discussion among the contractors present.

Other representatives of the supply trade present were the following: Arthur F. Sawyer, of the home office of the William H. Page Boiler Co., Norwich, Conn.; C. S. Wood, Keasbey & Mattison Co., New York; P. H. Seward and Homer Addams, Model Heating Co.; Frank Sprague, Howard Thermostat Co.,



Across Lake Erie

BETWEEN

TWILIGHT AND DAWN

The D. & B. Line Steamers leave Detroit weekdays at 5:00 p. m., Sundays at 4:00 p. m. (central time) and from Buffalo daily at 5:30 p. m. (eastern time) reaching their destination the next morning. Direct connections with early morning trains. Superior service and lowest rates between eastern and western states.

Rail Tickets Available on Steamers

All classes of tickets sold reading via Michigan Central, Wabash and Grand Trunk railways between Detroit and Buffalo in either direction will be accepted for transportation on D. & B. Line Steamers.

Send two cent stamp for illustrated pamphlet. Address, A. A. Schantz, G. S. & P. T. M., Detroit, Mich.

DETROIT & BUFFALO STEAMBOAT CO.

PLUMBING AND HEATING BUYERS' DIRECTORY

UNITED STATES AND CANADA

Most Complete, Up-to-Date Directory of MASTER PLUMBERS and STEAM FITTERS, with CAPITAL used in business.

Trade Names, Closets, Bath Tubs, House Heating Boilers, Radiators, Lavatories, etc.

All goods classified with names of Manufacturers and Jobbers. Full of business information.

NOW READY. PRICE, $5.00

PLUMBING & HEATING PUBLISHING CO., Publishers

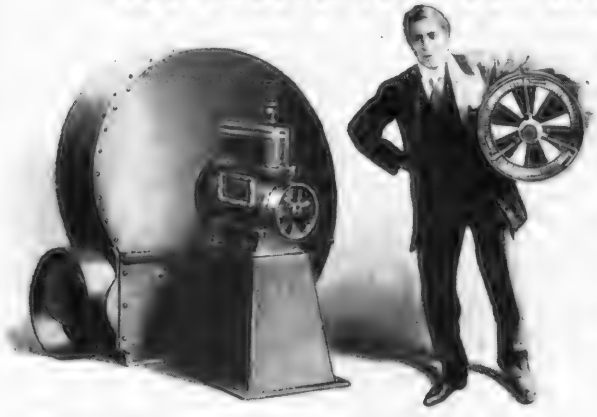
150 NASSAU STREET, NEW YORK

Oswego, N. Y.; S. P. McMullin and D. W. Lyle, Williamsport Radiator Co., Williamsport, Pa.; H. L. Anness and R. W. Hillman, of the home office, and W. E. Jacobus, of the Philadelphia office of the Richardson & Boynton Co., New York; H. H. Hess, of the New York office, and R. E. Kriebel, of the Philadelphia office of the United States Heater Co., Detroit, Mich.; Thomas C. Taylor, Vapor Heating Co., Philadelphia, Pa.; Frank J. Corbett, of the New York office of the Ashton Valve Co., Boston, Mass.; L. Moore, Abendroth Bros., Portchester, N. Y.; M. C. Honeywell, Honeywell Heating Specialty Co., Wabash, Ind.; O. P. Simler, of the home office, and W. Speakman, of the Pittsburgh office of the Union Radiator Co., Johnstown, Pa.; Secretary H. T. Gates and B. N. Hurd, of the home office, and William Grier, of the Baltimore office of the McCrum-Howell Co., New York; George D. Hoffman and A. P. Rowe, Norwall Valve Mfg. Co., Chicago, Ill.; George W. Barr, Isaac A. Sheppard Co., Philadelphia, Pa.; E. R. Euston, of the New York office of the Stoever Foundry & Machine Co., Meyersdale, Pa., who had a souvenir in the shape of a glass paperweight and dice; E. P. Allen, Dole Valve Co., Chicago, Ill.; James J. Lawler, Lawler Water Feed and Damper Regulator Co., New York; Thomas E. Crane, International Heater Co., Utica, N. Y.; E. L. Stark, president of the Chesapeake Supply Co., Washington, D. C.; E. O'Brien, Shirley Radiator Co., Indianapolis, Ind.; C. V. Haynes, Haynes-Thompson Co., Philadelphia, Pa.; A. F. Howe, Borden Co., Warren, Ohio; W. L. Herendeen, Herendeen Mfg. Co., Geneva, N. Y.; Albert B. Jenkins and W. G. LeCompte, of the home office, and J. D. Stiles, of the Boston office of Jenkins Bros., 71 John street, New York; George D. Bridgman, Bridgman Bros., Philadelphia, Pa.; Walter W. Talcott, Niagara Radiator Co., No. Tonawanda, N. Y.; Maxwell Gilbert, Gilbert-McCloskey Supply Co., Philadelphia, Pa.; William A. Russell, W. A. Russell & Co., New York; John H. Waters, National Radiator Co., Johnstown, Pa.; Harry S. Martin, of the home office; M. E. Danforth, of the Washington office, and W. S. Appleton, of the New York office of the United States Radiator Co., Dunkirk, N. Y.; Gilbert G. McDuff, of the Plumbing and Heating Publishing Co., New York.

New Firms

John T. Flaherty Co., Pittsburg, Pa., is a new pipe covering contracting firm composed of John J. Flaherty, Julius L. Miller and Joseph C. Graser, all of Pittsburg.

WING'S TURBINE FAN SYSTEM OF MECHANICAL DRAFT



The Small Fan under the man's arm takes the place of the large blower and engine.

means guaranteed economy of fuel, increased boiler capacity, absolute simplicity.

First and operating costs less than any other system and equals the results of the best.

Requires no floor space and little attention.

Catalogue gives full details.

L. J. WING MFG. CO.

West and Cedar Sts.
NEW YORK

Mfrs. Wing's Disc Fans, Blowers and Exhaust Fans

Designers and Builders of Heating and Ventilating Systems

G. R. Feld & Co., Pittsburg, Pa., is a new heating and plumbing firm located at 4039 Pennsylvania avenue.

General Heating and Construction Co., Little Rock, Ark., issued two promissory notes amounting to $15,000 to the German National Bank. The notes were endorsed by William G. Andrews, who became liable. The bank has secured a default judgment against him of $17,293.05 representing principal and interest.

Decatur, Ill.—The suit started by Joseph B. Perkins, trustee in bankruptcy for the Decatur Plumbing & Heating Company estate, Decatur, Ill., against the Citizens' National Bank of Decatur, W. H. Elwood, H. E. Kizer, W. E. Adams, J. B. Bullard and their wives, and J. L. Drake, has been decided by the United States Circuit Court of Appeals in Chicago in favor of the defendants. This decision sustains Judge Humphrey's decision that a note of $4,500 given the bank, on which the name of the corporation company did not appear, but which note was signed by W. H. Elwood and H. E. Kizer, and was endorsed by W. E. Adams, J. B. Bullard and their wives, and also by J. L. Drake, and given to take up one that had been made by the Plumbing & Heating company, and which note was paid just before the bankruptcy, did not make the bank a preferred creditor, as alleged by Receiver Perkins.

San Francisco's chief building inspector, John P. Horgan, reports during the year beginning May 19, 1906, that 8,828 building permits were issued, the total valuation of the structures being $68,575,067.

Gadsden Pipe & Fitting Co., Birmingham, Ala., has been organized to take over the plant of the Gadsden Pipe & Foundry Co., at Gadsden, Ala. H. Hammond and associates are members of the new company.

Roberts Heating Co., Minneapolis, Minn., will build a 4-story building in that city for its own use.

W. W. Patten, Pittsburg, Pa., formerly of the W. W. Patten Co., has assumed charge of the heating department of the James Hay Co., of Allegheny.

Manufacturers' Notes

McCrum-Howell Co., New York, has decided to use the name Richmond as a trade name for its entire product. The company will build an addition 70 by 170 feet to its plant at Uniontown, Pa., which will increase the output of the firm's radiation from 3,000,000 to 5,000,000 square feet.

Lunkenheimer Co., Cincinnati, Ohio, has increased its capital stock from $500,000 to $2,000,000.

Zinc-Coated Steel Slip Nipples

For Steam and Hot Water Radiators and House Heating Boilers

THE PRATT CHUCK CO., Frankfort, N.Y.

FREE SAMPLES furnished to interested parties

United States Radiator Co., Dunkirk, N. Y., has increased its capital stock from $200,000 to $300,000. The company may build a new plant.

Dole Valve Co., Chicago, Ill., has taken over the E. P. Allen Valve Company and will market the E. P. Allen air valves.

H. B. Smith Co., Westfield, Mass., has moved its Pittsburg office from the Lewis Building to 506 Hartje Building, where additional space has been secured.

Kieley & Mueller, New York City, have issued their 1907 catalogue of original and genuine specialties. A list of the subjects covered is as follows: Reducing valves for all purposes, back pressure valves for all purposes, atmospheric relief valves for all purposes, steam traps for all purposes, damper regulators, hot water temperature controllers, steam and water separators, oil and grease extractors (their 1906 type especially), pump regulators, return steam traps, water feeders, boiler feeders, grease and oil traps, water arches, emergency valves, low water alarms, high and low water alarms, strainer connections of various kinds, drip tank controllers, float valves, tank pump controllers, pump governors and receivers, combination muffler and grease extractor tanks of various types, feed water heater and purifiers, waste heat utilizers of various types that save coal. Special apparatus of any kind in their line made up, if possible to do so. Copies of the firm's catalogue will be sent on application. The western branch is the Western Kieley Steam Specialty Co., Chicago, Ill., which carries a complete stock for filling orders promptly.

New Corporations

Pierson Plumbing Co., Morristown, N. J. Capital stock, $25,000. Incorporators: Edwin Weir, Theodore Irving, Mitchel F. Hillock and Frank E. Pierson.

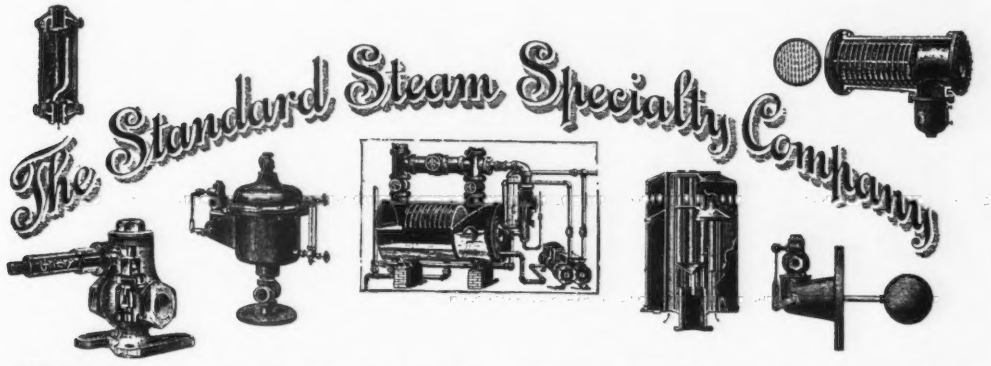
Miller-Haljerson Plumbing Co., Kansas City, Mo. Capital, $5,000. Incorporators: F. W. Miller, Anna Miller and Martin Haljerson.

Cooper Brothers Plumbing Co., Springfield, Mo.; capital stock, $25,000, to take on the business of Cooper Bros.

Akron Plumbing & Heating Co., Akron, Ohio. Capital stock, $15,000. Incorporators: Frank L. Prior, Fred S. Vial, R. H. Vial and K. Vial.

Globe Heater Co., St. Louis, Mo., capital stock, $10,000, to manufacture water heaters and hot water boilers. Incorporators: Dudley Shaw, Robert M. Shaw and Joseph E. Howard.

William H. Kay Co., New York; capital stock, $10,000, to manufacture steam fitting and plumbing supplies. Incor-



UTILITY Exhaust Muffler, Oil Separator, Return Tank Pump Governor and Feed Water Heater

UTILITY Vertical Steam Receiver and Separator

UTILITY Pump Governor Valve and Head

UTILITY Pump Governor Valve

UTILITY Steam Separator

UTILITY Pump Governor

UTILITY Exhaust Head

Specify **Utility** Specialties in your work and we will guarantee their value in use.

Send for Catalogue H

542-544 WEST BROADWAY, NEW YORK

porators: Edgar A. Monfort and Fred Knowlton, of New York, and Elbert L. Barney, of Edgewater, N. J.

Brooks Heating Specialty Co., St. Louis, Mo. Capital stock, $15,000. Incorporators: R. William McCallum, L. Walter Moon, and Stephen H. Brooks.

Fargo Plumbing & Heating Co., Fargo, N. D. Capital stock, $25,000. W. J. Price, president; P. W. Farnham, secretary and treasurer.

Hopkins-Jordan Co., New York. Mr. Hopkins and Mr. Jordon were formerly connected with the Rossman-Bracken Co. of New York.

J. L. Vinson Co., Raleigh, N. C.; capital stock, $10,000, to conduct steam heating, plumbing and gas fitting business. Incorporators: G. L. Vinson, F. B. Vinson, J. M. Broughton, S. A. Broughton and W. C. Underhill.

Standard Fitting & Valve Co., Guelph, Ontario; capital, $100,000, to manufacture steam fitting and plumbers' brass goods. Incorporators: John M. Taylor, George D. Forbes, Henry Aird, George W. Aird, and E. S. Platt. The company will build a $100,000 plant at Guelph.

Ingalls & Kendricken, Boston, Mass., has been incorporated with a capital stock of $100,000. Incorporators: Paul H. Kendricken, John W. Kendricken and Luther A. McCurdy.

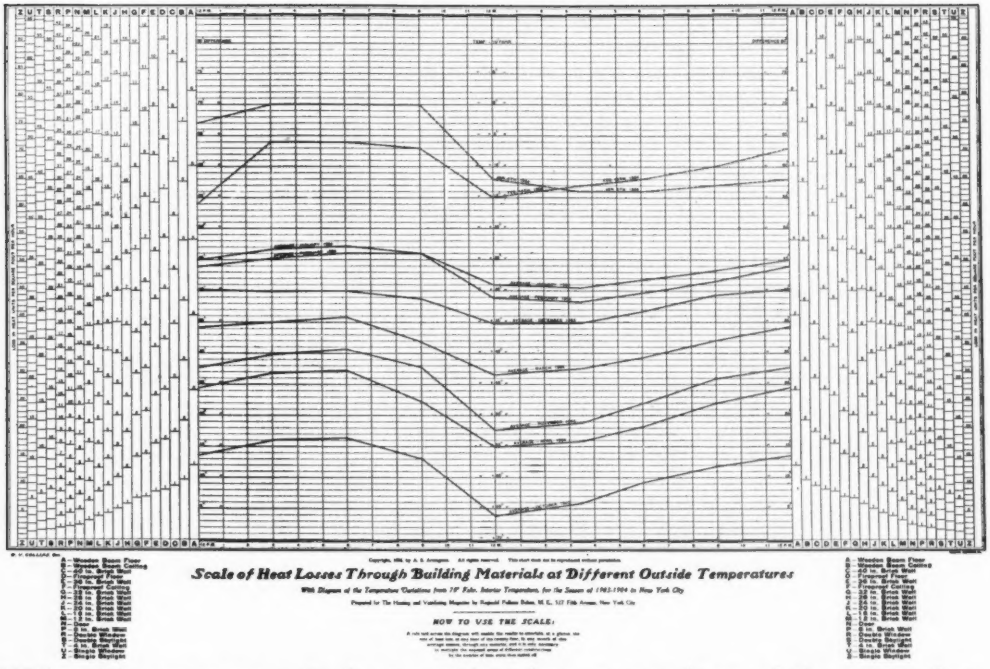
Herrington Brothers, New York; capital stock, $10,000. Directors: J. J. Herrington, Matilda J. Herrington and L. J. Herrington.

Palmbeck Heating and Construction Co., Rock Island, Ill. Capital stock, $8,000. Incorporators: Henry W. Palmbeck, John Staack and P. Sundstrom. The corporation will take over the business conducted by Henry W. Palmbeck.

Hallett Line Heating and Lighting Co., Hallett, Okla. Capital stock, $80,000. Directors: A. F. Wolf, Richard Geiger,

THIS CHART

Reduced from 26 x 14 inches



Scale of Heat Losses Through Building Materials at Different Outside Temperatures

With Diagram of the Temperature Variations from 70° Fahr. Interior Temperature, for the Season of 1903-1904 in New York City

Presented by The Heating and Ventilating Magazine, by Reginald Pelham Bolton, M. E., 527 Fifth Avenue, New York City

HOW TO USE THE SCALE:

Will enable you to ascertain the rate of heat loss, at any hour of the twenty-four, in any month, through any building material, in any section of the country where the weather conditions are similar to those in New York City, based upon the weather records for the past ten years.

Price, 50 Cents Each

Five Copies for $2.00

Address THE HEATING AND VENTILATING MAGAZINE

1123 Broadway, New York

Fayetteville, Ark., and W. C. Wolf, of Hallett.

Raney Heating and Plumbing Co., Cleveland, Ohio. Capital, $10,000. Incorporators: George D. Raney, Louis J. Sloat, Ray R. Raney, Della T. Brooks and Walter F. Brooks.

Tullis & Co., New York (heating plant). Capital, $20,000. Directors: E. E. Tullis, A. R. Burnette and R. A. Silk, New York.

Geissinger Regulator Co., New York, with a capital of $25,000, to manufacture temperature regulating devices. The directors are J. G. Kahely, H. G. Geissinger and J. R. Wemlinger, all of Brooklyn.

Craighead Plumbing and Electric Co., Richmond, Ind. Capital, $15,000, to continue business of Zoller & Craighead. The incorporators are E. W. and G. W. Craighead, G. W. Jaffries and W. H. Kelley.

C. W. Richards Co., Bridgeton, N. J., capital $25,000, to conduct a heating and plumbing business. The incorporators are A. E. Custer, H. R. Cole and J. F. Johnston.

Business Chances

Washington, D. C.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until 3 P. M., July 9, 1907, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the U. S. Post Office and Court House at Colorado Springs, Col.

Washington, D. C.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until 3 P. M., July 10, 1907, for the construction of an extension, remodeling, etc. (including plumbing, gas piping, heating apparatus, electric conduits and wiring and lift), to the U. S. Post Office and Court House, Knoxville, Tenn.

Washington, D. C.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until 3 P. M., July 1, 1907, for the construction (complete), including heating apparatus, plumbing, gas piping, electric conduits and wiring, of the U. S. Post Office at Ithaca, N. Y.

Washington, D. C.—Sealed proposals will be received at the office of the Supervising Architect until 3 P. M., July 2, 1907, for the construction of an extension, remodeling, etc. (including plumbing, gas piping, heating apparatus, electric conduits and wiring), of the U. S. Court House and Post Office at San Antonio, Tex.

Washington, D. C.—Sealed proposals will be received at the office of the Supervising Architect until 3 P. M., July 8, 1907, for the construction of an extension, remodeling, etc. (including

Thermostatic Regulation

as manufactured
and installed by the

National Regulator Company

is the most simple and effective of any on the market.
For the proper control of Dampers and Valves in a
Heating Apparatus it has NO EQUAL.
Write for Catalogue and find out why.

CHICAGO
334 Dearborn St.

NEW YORK
1135 Broadway

plumbing, gas piping, heating apparatus, electric conduits and wiring), of the U. S. Post Office and Court House at Fort Worth, Tex.

Leavenworth, Kan.—A new heating system will be installed in the military prison at Fort Leavenworth.

Washington, D. C.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, until 3 P. M., July 15, 1907, for an extension, remodeling, etc., including plumbing, gas piping, heating apparatus, electric conduits and wiring, to the U. S. Post Office and Custom House at Sheboygan, Wis.

Contracts Awarded

William M. Carmen, Portland, Me., heating system for the Frederick Robie school at Graham.

Messinger & Sullivan, Logansport, Ind., heating new school building at Barrows for $1,690.

F. S. Schardein & Sons, Louisville, Ky., heating and plumbing new Cohen apartment building. Contract price $7,000.

A. Aschaffenburg Co., New Orleans, La., heating and plumbing system for the new Hotel Grunewald, including 200 bathrooms. The contract will amount to over $80,000.

Fargo Plumbing & Heating Co., Fargo, N. D., heating and plumbing three-story addition to the Institution for the Feeble Minded at Grafton. Consideration, $6,854.

National Heating Co., St. Louis, Mo., heating system for public bath house on Tenth street.

Peck-Hammond Co., Cincinnati, Ohio, heating and ventilating system for Oyler School, $18,459; Twenty-second District school, $16,899, and Central Fairmount school, $18,459.

Anderson-Darragh Co., Pittsburg, Pa., hot water heating $15,000 residence for Miss Mary Baird.

Harris & Taylor, Sharpsburg, Pa., hot air heating plant for apartment building at 351 Butler Street, Pittsburg.

Regan & Hornell, Charleroi, Pa., steam heating new $30,000 Turner Hall for the Charleroi Turnverein Association.

McGinness-Smith Co., Pittsburg, heating Western Pennsylvania Exposition Society Music Hall on Duquesne Way.

Ruud Mfg. Co., Pittsburg, Pa., contract for automatic hot water storage system for University Club, Welfare Building of the Y. M. C. A. Hot water will be furnished to a large swimming pool and to 60 showers, in addition to that used for other purposes. The system will have a capacity of about 2,000 gallons per hour.

John G. Sutton Co., San Francisco, Cal., hot water heating for 3-story, Class C, hotel building for A. Hasshagen. This firm also has the steam heating contract, amounting to $2,000, for a 7-story brick building owned by F. & A. Barnch. Also pipe work, amounting to $2,300, for building of N. W. Halsey & Co.

H. C. Newman Plumbing & Heating Co., Evansville, Ind., heating and plumbing office and freight station of Southern Railroad Company at Evansville.

O'Mara Heating Company, St. Louis, Mo., hot water heating plant for apartment building for the Trinity Realty Co.

J. J. Hanighen, Omaha, Neb., heating and plumbing new hotel on Sixteenth Street.

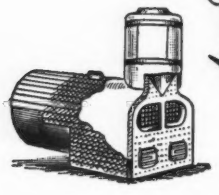
Grunwald, Schroeder & Co., Omaha, Neb., heating and plumbing new Y. M. C. A. building in Omaha.

American Foundry & Furnace Co., Milwaukee, Wis., heating new school house at Antigo, Wis.

James S. Cole, Lisbon, N. D., heating and plumbing Commandant's residence at the Soldiers' Home in Lisbon.

J. T. Underhill & Co., Cincinnati, Ohio, heating new tobacco factory of Lowell & Buffington Co., at Covington, Ky.

TELEPHONE CALL 6097 FRANKLIN.



ESTIMATES FURNISHED AND CONTRACTS EXECUTED.

ROBERT A. KEASBEY CO.

HEAT AND COLD INSULATING MATERIALS

HEADQUARTERS FOR
85% MAGNESIA, ASBESTOS AND BRINE
PIPE COVERINGS, ASBESTOS PRODUCTS, ETC.

100 NORTH MOORE ST, NEW YORK CITY.